THE

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(J. A. BERLY'S).

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THE JAPAN-BRITISH EXHIBITION.

ON Friday last week, the then Lord Mayor of London (Sir G. Wyatt Truscott) presided at the last of the Mansion House functions which have signalised his civic reign, and we may be pardoned if we look upon it as the most important, in view of the far-reaching effects it ought to produce upon the commerce of this country, especially in so far as it applies to our engineering and industrial undertakings. The occasion was a luncheon, to which a distinguished company numbering some 140 well-known gentlemen had been invited to meet Prince Arthur of Connaught, the Honorary President of the Japan-British Exhibition to be held next year at Shepherd's Bush; with what took place we deal in another column.

Exhibitions of various kinds have been held in practically every country of importance on the face of the globe from the time of King Ahasuerus to the present day, but we shall only concern ourselves with a few of these, commencing with the first great International Exhibition held in London in 1851, by the Society of Arts, under the Presidency of the late Prince Consort. Previous to this, such displays had been confined to the products of the country in which they took place. All nations were invited to compete in 1851, and the Exhibition remained open for 5½ months. The total number of exhibitors was 13,937, of whom 6,861 were contributed by Great Britain, 520 by the British Colonies, and the remaining 6,556 by foreign countries.

Others followed in New York and Dublin in 1853, Melbourne and Munich in 1854, and Paris in 1855, but the next great world's fair was held in London in 1862; still, none of the International Exhibitions between 1857 and 1873 had attracted as many as 7,000,000 visitors, probably because of the want of education amongst the masses and the lack of facilities for locomotion. The greater facilities, however, brought about by the extensions of railway systems in every part of the civilised world, together with an ever-growing population, considerably increased the attendances at subsequent shows, and at the Centennial Exhibition, held in Philadelphia in 1876, to celebrate the one-hundredth anniversary of American independence, the number of visitors totalled nearly 10 millions, of whom over 8 millions paid for admission. In Paris, too, in the year 1878, the number of paying visitors amounted to 13 millions; and in 1889, to the then unprecedented number of over 25 millions; but in 1900, 39 million persons paid for admission, and the Exhibition was largely visited by foreigners. A new plan of classifying exhibits was here adopted, all being displayed according to their nature and not according to their country of origin, as had been the system at previous Exhibitions. One half the space in each group was allotted to France, so that the exhibitors of that nation were enabled to overwhelm their rivals by the number and the magnitude of the objects displayed by them, there being

no exclusively British and no exclusively German Court. The United Kingdom was well, but not largely, represented, both in Fine Arts and Manufactures, the administration of the section being in the hands of a Royal Commission, presided over by the Prince of Wales, now King Edward VII. For the first time since the war of 1870, Germany took part in a French International Exhibition, and showed the great industrial progress which had been made since the foundation of the Empire in the above-mentioned year.

France maintained her superiority in all the objects in which good taste was the first consideration, but the more utilitarian exhibits were remarkable for their number rather than their quality, except those connected with electrical work and display, automobiles, and ironwork. The number of exhibitors in the Industrial Section from the British Empire, including India and the Colonies, was 1,250.

There is no need further to labour the story of bygone exhibitions, so we will return to our muttons and express the hope that history will repeat itself, and that the Japan-British Exhibition will achieve as colossal a success under the honorary presidency of Prince Arthur, as did the International Exhibition of 1851 under the wise guidance and large-minded views of his illustrious grandfather.

The idea was Prince Albert's own, but he had to work for its realisation against an extraordinary outburst of angry expostulations. In these days of enlightenment it is difficult to believe that every stage of his project was combated; that in the Upper House, Lord Brougham denied the right of the Crown to hold the Exhibition in Hyde Park; and that in the House of Commons Colonel Sibthorp prophesied that England would be overrun with foreign rogues and revolutionists, who would filch our trade secrets from us, he being apparently oblivious of the fact that our own countrymen would have equal chances of learning—we will not say filching—the trade secrets of their Continental competitors. Every post brought the Prince, as President of the Exhibition Commission, abusive letters, accusing him, as a foreigner, of being intent on the corruption of England. But he was not the man to be influenced by threats or charges of this kind, and he quietly persevered, with the result we know so well, for he had a profound belief that the manufacturing power of Great Britain would be quickened and stimulated by the bringing together of foreign manufactures and products in addition to our own. It may be interesting to add that the surplus of £150,000, after all expenses had been paid, was spent on establishing and endowing the Museum at South Kensington and on the purchase of land in the neighbourhood.

The interest of His Majesty the King—the sanest monarch, as a *Westminster Gazette* correspondent happily expressed it the other day, who ever adorned a throne—in the forthcoming Exhibition is well known; the Prince of Wales for several years has been striving to wake up England, and now Prince Arthur has shown that he is a worthy worker in the same good cause, the cause, as the Lord Mayor aptly termed it, of calling the British manufacturer to arms, so as to increase our already great trade with a nation ready and willing to be our customers.

Will the British manufacturers accept this call to arms, and show that the belief of Prince Arthur that they realise the importance of the occasion, the belief which animated the Prince Consort in 1851, is justified, by coming forward with one accord as in the Great Exhibition of 58 years ago, and making the Japan-British Exhibition worthy of themselves and of the marvellous Eastern race with which we are to be associated in the arts of peace? Or will they allow our ever alert, industrious, and sober allies, whose preparations have been made on the most elaborate scale and are now in a very advanced state, outvie the old country even in those industries in which we have hitherto prided ourselves as standing pre-eminent?

We have not forgotten the Milan Exhibition of 1906, in which we were personally interested, and it way be well to repeat some of the strictures we made on the apathy of the British manufacturer towards that exhibition, indubitably one of the greatest of modern times. In a retrospect published in an issue of January 11th, 1907, we said:—

> It is somewhat the fashion to sneer at and disparage exhibitions among those who pose as the elect of the markets of the world, and who act as if there were no such contingency as the dissipation of business and its gradual extinction in the hands of those who take competition lying down. It is all very well, they say, for firms who are on the make to exhibit, and for nations who are struggling for share in the general trade of the earth to participate; we who have an established reputation among faithful clients, and who have more orders on our books than we can execute, have no necessity to show, and it is money in our pockets to keep away. Thereupon they do keep away, and with them many minor firms refrain from exhibiting who possess no such spacious excuse for absenting themselves, and Great Britain makes herself once more chiefly conspicuous by her absence.

But the lapse of three years has brought with it half depleted workshops with few fresh orders coming in to keep the machinery running, while dividends have become smaller and beautifully less; we have no longer, therefore, the excuse above mentioned to make us refrain from taking part in exhibitions, but every reason to once more assert ourselves in the way of other nations.

In our conversations with manufacturers at various times, one has said: "I know the Germans are keen and practical business people, they are serving many of the customers I used to serve, and they exhibit extensively, but it is useless pretending I hold with exhibitions, for I don't believe it pays to exhibit." Another will argue: "What is the use of exhibiting in a country protected up to the hilt, you haven't a chance of pushing your goods there if you do show, for the duties kill them. Yes! I know that Protection hits others besides us, and that our goods pay the same as those of our competitors; but I don't hold with trying to do business in Protectionist countries."

These were some of the reasons given for holding aloof from the Milan Exhibition, and it was a matter for considerable regret that our leading electrical firms should have abstained from exhibiting to the extent that they did, as it gave a wholly false impression of the position we occupy in the electrical industries in the world—all the more so considering the enormous demands which were being made for new industrial installations in Italy on all the electrical houses in that country as well as in Switzerland, Germany, and France in which our own makers should have participated. The same thing may be said in the case of manufacturers of railway stock and locomotives. Here the supply offering for several years to come from Italian sources was ridiculously short of the demand, and the Italian Government would have been influenced to a large extent in placing their orders with us had our leading houses exhibited, as they were repeatedly asked to do. As it was, they had to content themselves with limiting their custom in this country to a few second-hand locomotives purchased from the Midland and Metropolitan Railways for immediate delivery, while Belgian and German firms, who made expensive and beautiful displays of rolling stock, almost entirely monopolised the orders for future delivery.

Milan did not appeal to anything like the extent that it should have done to British manufacturers and traders, owing partly to a mistaken idea of its importance, partly to a misapprehension of the effect of the Italian Protectionist policy on the opportunities for trade in that country, partly to a disinclination to exhibit, largely engendered by self-sufficient complacency in our commercial position in the markets of the world—and partly to the lazy habit produced by over-prosperity in the past which prevents many from exerting themselves, even when face to face with loss of business, and makes them inclined to cry "Kismet" when it is actually gone.

It is abundantly clear that our somewhat halting participation had nothing whatever to justify it, and was a regrettable mistake from many points of view which it would not pay our manufacturers to repeat.

Now the Japan-British Exhibition stands on an entirely different footing, but what should we gain by exhibiting? What our reward? we can imagine the British manufacturer exclaiming.

That is difficult to answer in £ s. d., but even so long ago as the 1878 French Exhibition, it was stated at the time that, in addition to the impetus given to the trade of France, the revenue of the Republic and of the city of Paris from Customs and octroi duties was increased by nearly three millions sterling as compared with the previous year. And, as we remarked close upon three years ago:—

> No one can estimate the specific benefits conferred on the individual exhibitor or on the trade of the country to which he belonged through having participated at a great exhibition like Milan. Neither is it possible to estimate the benefits conferred on the country and the city where the exhibition is held. A balance-sheet of profit and loss would be almost as difficult to frame in the one case as in the other. But apart from individual profit, it is unquestionable that the fact of this show having taken place has led to the establishment of fresh and more extensive relations between manufacturers and consumers, not in Italy alone, but in several of the neighbouring States as well, and in others connected by close ties of relationship and interest with Italy. These relations have embraced more or less all those who have exhibited at Milan, and have certainly not left British exhibitors out in the cold.
>
> *Noblesse oblige* is a trite saying; yet its application to exhibitions among many other international matters is too often forgotten. The political standing of a nation in the comity of nations often compels it to take upon itself duties of a general character which are far from, or the reverse of, remunerative, and yet it dare not decline to do so, lest it should lose reputation, which is more valuable than money; indeed, the loss of which could not be measured in millions sterling. Even so there are certain classes of exhibits which nations in the foremost rank may not with impunity neglect to make; exhibits that under no conceivable circumstances can be made to yield any direct profit. These are in the fields of social economy, of public hygiene and of public education. The world at large expects a nation to show the best it produces in these fields of human energy; the foremost results and greatest achievements have to be placed at the disposal of, and demonstrated to, humanity at large on all suitable occasions. International exhibitions are among the most suitable of these occasions, and a nation which does not avail itself thereof loses caste, as it were, among other nations. We did not exactly lose caste at Milan in these respects, but we went perilously close to doing so.

It is useless to disguise the fact that English manufacturers have had serious misgivings as to the manner in which the exhibitions at the "White City" have been engineered; at the same time it must be confessed that the Anglo-French display of last year was in many ways a success. We are personally aware that for the forthcoming show the Exhibition authorities are leaving nothing undone to secure the best available chairmen, vice-chairmen, and members of committee for the various sections; gentlemen whose names will command the respect of Industrial England, and whose reputations are unsullied and beyond reproach.

Therefore we would urge that whatever circumstances may have arisen in the past to make exhibitors chary of participating in the world's fairs at Shepherd's Bush, all fears should now, like physic, be thrown to the dogs, and that we all combine to make English manufactures, English engineering, English art, science and literature, English everything, appear at its best, and show not only our Japanese friends and allies, but the whole world, that we can still hold our own against all comers.

Only last week we alluded to the fact that the British Government had not officially recognised the Exhibition although individual members of the Government were keenly interested in its success. Now that Parliamentary discussions seem to have completely lost their old-time dignity, now that both political parties are filling the air with "terminological inexactitudes" and "frigid calculated lies," and the Budget has changed old and tried friends into deadly foes, what a relief it would be if Mr. Balfour, with that charm of manner which Mr. Balfour alone possesses, would move in the House of Commons that the Government should officially take cognizance of the Japan-British Exhibition of 1910, and lend its support to the project. This would give that confidence to would-be British exhibitors which is now lacking and put the final touch, the official seal as it were, upon the genuine character of the Japan-British hyphen, which the Lord Mayor claimed as the happiest part of the title.

But even as it is, the refreshingly frank, boyish enthusiasm of Prince Arthur, the more matured experience of the Duke of Norfolk, whose interest in the domain of engineering and science we have long known, the co-operation of the City of London and of the leading City Guilds, combined with the support of the numerous influential commercial and technical gentlemen, some 200 or more, whose names appear in connection with the Exhibition, should make for complete success.

That there will be any want of enthusiasm on our part we are loth to believe, when we have the assurance of the Japanese Ambassador that the Emperor, his Government and the people of his country had been doing their best to make their exhibits worthy of the occasion; it rests, therefore, with ourselves whether or not we take advantage of the opportunity of a lifetime, and reap the benefit of an increased demand for British products, such as His Excellency foresees.

The Electrical Industry.

The opening of the new Session of the Institution of Electrical Engineers has let loose upon us a flood of retrospects, it being a deeply-rooted belief in many quarters that it is the duty of a chairman to devote his inaugural address to a review of the past history of the industry with which his hearers are connected. Useful lessons, can often be derived from such reviews, provided that they are not merely statistical compilations, but thoughtful and stimulating commentaries as well, for there is no better index to the future of an industry than a searching examination of its past.

Two of the inaugural addresses delivered in the provinces this year are of special interest. The first was read at Manchester by Mr. S. J. Watson, and besides giving an interesting table of statistics, showing the changes that have taken place in electricity supply during the last 15 years, embodies much useful information bearing upon commercial electricity supply. The second, on the other hand, by Mr. R. K. Morcom, who is not actually engaged in electrical engineering, but, as he aptly puts it, is direct-coupled to it, is a review of the manufacturing side of the industry, and presents the matter in a style so novel and illuminating that we have thought it well to reproduce the address in full. Mr. Morcom occupies a position which, while it brings him into close contact with electrical manufacturing, enables him to view the situation from an impartial standpoint, and his remarks are worthy of serious consideration.

It is satisfactory to note that Mr. Morcom regards British machines as "the finest in the world;" he goes on to say "at prices far below their true value," and we cordially endorse his opinion, which agrees with reports from other sources. He comments on the tendency of the large engineering factories to take up the manufacture of accessories, which he regards as a mistaken policy; in this he does not stand alone, and some instructive lessons might be derived from a comparative study of the results obtained by judicious specialisation, and by indiscriminate plunging into diversified manufacture.

"If all our works were full, the demands of our home and export trade would not be enough to take their output." Over-expansion, with the consequent increased severity of competition and lowered prices, has brought the industry into a depressed condition; but it has compelled reorganisation, and thus has resulted in increased efficiency, which should have its effect when conditions improve. The obvious need of our manufacturers is an increased export trade to take their output. We are doing all we can to stimulate their efforts in this direction, and we are assured that the opportunities are there, if they will only bestir themselves and take advantage of them. The protective tariffs of non-manufacturing countries are no greater bar to us than to our competitors, and our goods, once introduced, will bring repeat orders. Our export tables, unlike the data which Mr. Morcom quotes, indicate a steady and continuous rise in exports of electrical machinery, and we have full confidence in the future prosperity of the industry.

D

GAS POWER v. STEAM POWER FOR CENTRAL ELECTRIC GENERATING STATIONS.

By HORACE ALLEN.

When the London underground railways were electrified, in 1905, the power was supplied from a central station in Lot's Road, and necessarily the capacity required rendered the station one in which large units could be employed with advantage.

The electric generators were provided with steam-driven turbines of the double-flow impulse and reaction type.

Although it is only four years since this plant was installed, it is stated that, owing to the high consumption of steam, the original turbines are to be replaced by others of the standard Parsons type, which will, it is claimed, reduce the steam consumption by from 6 to 7 lb. per KW.-hour, thereby reducing the fuel cost by £30,000 per annum.

Seeing that economy in fuel consumption, by the employment of an improved class of turbine, is of sufficient importance to warrant the discarding of the original engines in such a short period as four years, it naturally occurs to engineers that the higher fuel economy of gas power would, in this special case, have promised such a further reduction in fuel cost as to render its application advisable.

If the new turbines, of the standard Parsons type, are capable of producing full-load current at a consumption of steam of 13·4 lb. per KW.-hour, the original machines must have been requiring about 20 lb., which, at an evaporation factor of 8 to 1, represents 2½ lb. of coal per KW.-hour.

Under the same conditions gas engines would have reduced the consumption by 1½ lb. of coal, and the saving would have been £55,000, as against £30,000 by the new turbines, or £25,000 more than will result from the replacing of the original turbines by more modern economical ones.

For an installation of 10,000-KW. capacity, with 1,450-KW. gas-driven units, the extra expenditure per B.H.P. has been estimated at about 31s. per B.H.P.* more than that of steam plant with turbines of high economy, and, with coal at 12s. per ton, the percentage of profit on the extra capital outlay is calculated to be over 35 per cent.

The higher cost of a gas power installation is due to the comparatively small units considered as available at the present time when compared with steam-driven units, and the resulting increased area of ground occupied by the gas engines and gas treatment plant. However, for such a large power installation it is probable that gas engines of about 4,000 H.P., which can now be obtained, would have been adopted, in which case the relative capital expenditure would not be so high as stated; as, for a 10,000-KW. plant, the extra cost of a gas-driven plant is considered to be only 19 per cent.

The relative coal consumptions taken as a basis are obviously those to be obtained under full load, without including accessories, but they are only employed to arrive at comparative economies; however, it has been estimated in a comparison between gas power and steam power, in the case of an installation of 10,000 KW. working under a 24 per cent. load factor, that with gas the cost of fuel was 21 per cent. of the total running costs, while for steam it was over 48 per cent.*

Taking into consideration the situation of the station on the banks of the Thames, where coal is expensive, and any variety could be obtained to suit the requirements of bituminous producers without increase in price, there should be no difficulty in regard to satisfactory generation of a suitable quality of gas; while the capacity of the station would allow of full advantage being taken of the economies due to the recovery of by-products and their market value.

In this connection, Mr. G. L. Addenbrooke† has said: "The economy of using the gas engine will, of course, be much greater in districts such as London and on the banks of the Thames, and in other similar places where much power is used, and where the price of coal is much higher than in the industrial districts near the coalfields."

Mr. Addenbrooke, while drawing attention to the greatest advantages of gas engines being obtained at or near full load, and proposing a combined gas and steam installation, owing to the latter being better able to deal with large variations in load, does not draw attention to the fact that gas engines, of even the largest sizes, are capable of being started from cold to full load in a fraction of the time possible by steam, while the standby costs are much lower.

It is therefore within the range of possibility that within another short lapse of years, a further change may be made at the Lot's Road station, and before the new turbines have fulfilled their allowance for depreciation.

* "The Use of Large Gas Engines for Generating Electric Power," by Leonard Andrews and Reginald Porter, Institution of Electrical Engineers, 1909.

† Royal Society of Arts, Cantor Lecture.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Electric Oven.

I would be much obliged if any of your correspondents could tell me the name of the maker of a small oven for cooking sample biscuits. Such an oven does not require to be of large size, but it should be strong and capable of being washed without falling to pieces and without damage to its elements.

C. Turnbull.

Electricity Works, N. Shields,
November 8th, 1909.

A Question on Load Factor.

Very many thanks to "Return" for kindly answering my query on the above matter, but I am still uncertain how to arrive at a conclusion, as the battery is charged up only three times each week, being twice brought up to gasing point and the third time gased for one hour.

The battery is never out of service during the day's run, and it is always necessary to run one engine for a portion of each day, and the second engine occasionally.

Ratio.

The Coefficient of Self-Induction.

I have to thank Messrs. Cramp and Smith for recommending a few quotations from some of my letters "to the earnest consideration of practical engineers and designers." I hope they will do some good in this connection, but they were primarily intended for the serious consideration of writers of books on the "Theory of Alternating Currents."

It is possible that some of your readers may be ignorant of certain well-known electrical theorems. The quotations also being couched in scientific language, and, therefore, not being easily understood by those unfamiliar with the subject, some may be led to infer that Messrs. Cramp and Smith are demonstrating that your reviewer has been talking nonsense, or, at least, that he has been continually contradicting himself. Of course this is not their intention. I am well content with all their quotations with the exception of No. 5. In this case, doubtless owing to their anxiety to do me justice, they have amended what I wrote so as to give it a meaning which I never intended. May I be permitted, Sir, to expound a little more fully some of the scientific theorems which the authors very properly commend.

Before doing this, I should like to state that, in my opinion, an appeal to Reason is ever preferable to an appeal to Authority. I find that Thompson, Steinmetz, Kapp and Russell are arrayed against me by the authors. As I am thus challenged, I am forced to state that there is much that

is crude, there is much that is badly expressed, there is much even that is illogical and wrong in some of the authorities quoted. But this does not make the notion that self-inductance can be represented by a complex variable less ludicrous.

Many designers of alternating-current apparatus, and your reviewer has the honour to number several amongst his personal friends, read through certain incantations from the treatises on which Messrs. Cramp and Smith rely before going through the preliminary cabalistic operations in connection with self-induction, which they think an essential part of their computations. Naturally, they have not much faith in the results, and check them from their own practical data. Their self-induction calculations are, in fact, a "botching piece of work," and they are grateful to anyone who will throw light on the subject.

Let us now consider quotation No. 7: "If the wire of a coil be infinitely thin, the inductance is infinitely great whatever may be the shape of the coil." Why is this quoted? Do Messrs. Cramp and Smith mean the reader to infer that it is wrong? Let me try and convince them. The self-inductance of two equal parallel wires is universally believed to be given by—

$$l\left(4\log_{\epsilon}\frac{d}{a}+1\right),$$

where l is the length of the wires, d the distance between their axes, and a the radius of either wire. This formula will be found in the standard text-books. Now let them put a equal to zero in the above formula; noticing that d/a becomes infinite in this case, and that the logarithm of an infinite number is itself infinite, they will see that the self-inductance is infinite. This is not an isolated case. Your reviewer is prepared to quote dozens of other formulæ to prove that self-inductance becomes infinite when the wire is infinitely thin, and that when the wire is thin, the self-inductance varies enormously with the diameter of the wire. In fact, he cannot see that it could possibly do anything else.

But this does not agree with the notions of the multitude? Then who is to blame? Who has blinded them? Who is telling them to shut their eyes lest they see the truth and so forsake the Temples and cease to bring tribute to the High Priests who minister therein?

No. 6. "The idea of equivalent sine waves was exploded some years ago." Your reviewer remembers pricking the bubble in your columns several years ago when criticising another book, but he may as well prick it again. The definition (Steinmetz) of equivalent sine waves only takes into account the effective values and the phase differences of the two waves. There is, therefore, an infinite number of pairs of waves which can be represented by the same two "equivalent" sine waves. They cannot, therefore, take into account the area and the maximum amplitude of the applied potential difference wave.

Now it is known that the magnetic flux in the core of a transformer varies as the area of the applied potential difference wave, and that the stress on the insulation of its windings varies as its maximum amplitude. The "equivalent" sine waves do not take into account the areas and the maximum heights of the original waves, and, therefore, they are very far from being equivalent to them.

But they are practically equivalent? No, they are not. Prof. Roessler proved experimentally, 14 or 15 years ago, that the magnetising current, the core losses, the magnetic leakage, the voltage drop and many other characteristics of a transformer varied very appreciably with the area of the applied wave, although the effective value of the applied potential difference was maintained constant. Messrs. Taylor, Beeton and Barr proved this also in their Institution paper read in 1896. It is necessary to dwell on these points, otherwise practical men will lose faith in theory if hasty and ill-considered artifices are forced on them which are incapable of explaining the observed facts.

Why do the authors quote the statement that the flux is a "double valued function of the current," and write (*sic*) after it? Is it gibberish to them, or do they mean to deny it? The flux varies with the current, and for a given value of the current it has in general two determinate values, one when the current is increasing, and one when it is diminishing. This is obvious from an inspection of Ewing's hysteresis loop. The function is, therefore, double valued—a phrase which will be found in advanced physical and mathematical treatises.

Although I regret that Messrs. Cramp and Smith do not intend to continue this correspondence, yet I hope that they, or some of your readers, will be tempted to discuss the subject further. In my opinion, the self-induction theory of circuits with iron in them is dead, and little, if anything, is to be gained by trying to galvanise it into life. Recent attempts in this direction have only led to a hopeless jumble of definitions of "inductance," "self-inductance" and "coefficient of self-induction," none of which are scientifically accurate.

Your Reviewer.

L.C.C. Motor-Generator Contract.

With reference to your leader in to-day's issue, "Common-sense Contracting," *re* the order for the 500-kw. motor-generator, which has just been placed by the L.C.C., we think that it should be stated, in justice to the unsuccessful tenderers, that this specification, which was advertised in the ordinary way as a specification for a 500-kw. motor-generator, specified the exact sizes to which everything had to be made, the windings, the details of the insulation, and, in fact, the whole of the particulars of the machines. In our case, and no doubt in the case of other tenders also, these dimensions did not fit in at all with our standard sizes, and hence we quoted for our standard machines, which we guaranteed to be satisfactory in operation.

We think that the L.C.C., when calling for tenders for a particular class of machine, with all the dimensions specified (presumably to be interchangeable with machines they already have), should state this in the advertisement, so that firms who were not willing to make special machines for them would not apply for the specification.

The Lancashire Dynamo and Motor Co., Ltd.,
A. P. Wood, *General Manager and Director.*

Manchester, *November 5th*, 1909.

Voltage for Country House Installations.

I think "H. C. P." is making a mistake in advocating high voltages for country house lighting. We have followed the false scent of high voltages all too long; it very soon got us into difficulties with our arc lighting. We could not burn arcs singly without a wasteful resistance. Manufacturers of heating and cooking apparatus prefer 100 volts to anything higher. Fire insurance companies cordially dislike high voltage, and have commenced to make war on it; and now it has left us floundering in a slough of despond because we cannot make satisfactory use of the metallic lamps, which would have done so much to help us to success.

The difficulties connected with low-voltage lighting are not anything like so great as those which have been overcome with high voltage. There is a plating workshop in London which is lit by current from the electro-plating dynamo at 4 or 6 volts. Our offices and showroom are lit at 10 volts, our workshops at 16 volts, and our small lighting sets on test are made to drive the machinery in the shop by means of a 16-volt motor. We have a private house lit at 12 volts, and the bells, telephones, fans, &c., are run from the same supply as the lamps and at the same voltage.

Two of our 25-volt installations are houses changed from 100 volts—in these two instances we did expect some difficulties, as we had to deal with long mains—and we had water boilers to provide in two cases, and an arc lamp for a magic lantern. One of these installations has 200 lamps, and it is proposed to add 60 more—and from the success we have had I would not alter the voltage if 600 more were added.

To obtain satisfactory results, all that is required is plenty of copper in our conductors and good connections in our switches, fuses, &c. We provide 14 cells only in the battery room, and one cell in the house with a special switch, which gives 26, 28 and 30 volts.

I am advising this extra low voltage lighting for villages, garden cities and small towns, going as low as 8 volts, 6 volts, and even to 4 volts for very small houses. There is

nothing very wonderful about this when it is remembered that lamps of 8 c.p. can be had at 4 volts, 12 c.p. at 6 volts, and 16 c.p. at 8 volts, and I do not expect to find any difficulties to surmount so great as the opposition of electrical engineers who are not used to the idea of low voltages.

"H. C. P." fails to see any reasons for recommending 25-volt lamps. I can assure him there are some. They are cheaper, more economical, less fragile, more durable, smaller, more suitable for standards and brackets than the 100-volt ones; they are preferred by rich men who like brackets and candelabra with a number of small lights, and by poor men, who do not care to pay for 16 c.p. for their stairs, landings, passages, lavatories, bath rooms, &c., where 5 c.p. is sufficient for all their requirements.

If electric lighting is to become universal, it must provide a man with the light he wants, not with what some of us imagine he ought to have.

J. Jackson.

London, N.W., *November 8th*, 1909.

British Magnetos.

We have noted some correspondence in your columns with reference to the absence of an efficient British made magneto, and should like to add a few remarks on the subject.

Your first correspondent cannot have been aware of the exceedingly keen competition now going on between ourselves and the manufacturers of various foreign magnetos. We may say that at the present moment we are employing 350-400 men solely upon the manufacture of Simms British magnetos and sparking plugs, and we have a weekly minimum output of 300 magnetos. A number of the largest English motor and motor-car manufacturers have, after very exhaustive tests of our machines, decided to adopt them for the coming season as a standard.

We may also add that not only has the Simms British magneto become a recognised fact in this country, but we have also opened our own branches in New York and Paris, and have agents in Canada, South America, Australia, New Zealand, Belgium, Holland, Italy, Switzerland, &c., and have secured contracts with several large Continental and American firms for the next season's cars.

In order to assist the British magneto industry, prospective car purchasers should specify that a British magneto be fitted to their new cars, and to prove our capacity for turning out not only a British magneto but a first-class machine, our works are open to inspection.

The Simms Magneto Co., Ltd.
T. Savage,
Assistant Manager.

London, N.W., *November 3rd*, 1909.

The Electrical Vehicle in the States.—At a meeting of the Electric Vehicle and Central Station Association, held at Boston, U.S.A., on October 13th, President Stone briefly referred to the progress of the electrical vehicle in Boston within the past 21 months. He said it was estimated that there had been an annual increase of 231,000 units for commercial vehicle service and 95,000 units for pleasure vehicle use; this at 4 cents for commercial and 7 cents for pleasure purposes represented $15,876 additional revenue per year. In all New England the year's increase in revenue on vehicle account amounted to $28,000. Boston had now six electric garage and 88 charging stations. In emphasising the value of this business to the central stations, Mr. Stone showed that the energy consumption of a light commercial vehicle over a year was equal to seven 550-watt arcs (burning four hours per day), 320 50-watt incandescents (burning one hour), and 61 500-watt flat-irons (working 156 hours per year). A heavy commercial car on the same basis was equivalent to 18 arcs, 800 incandescents and 153 flat-irons. A paper dealing with the New York Edison Co.'s vehicle service was read, from which it appears that 65 cars are in service, equipped generally with 40 to 44 Exide cells, and used by the officials also as lamp wagons, emergency cars, for general delivery purposes, and for hauling arc lamps, signs, cable, &c. Among other particulars given, it was mentioned that 23 general delivery wagons, each of one ton capacity, run 35 miles on one charge, the positive plates having a life of 390 days and 8,635 miles, and the negatives 670 days and 11,814 miles. Five five-ton cable trucks, running 15 miles a day on one charge, are equipped with 48 cells each, the positive plates having a life of 395 days on 3,733 miles, and the negative of 461 days on 9,630 miles running. The tire life on the older cars amounted to 10,000 miles; the company assembles its own batteries, a hydraulic lift enabling them to be changed in 12 minutes.

TESTS OF THE FREUND BRAKES.

An interesting demonstration of tramcar brakes which have been designed by Mr. Edwin Freund took place on Thursday last week, at Liversedge, before the members of the Yorkshire Tramway Managers' Association. There was a representative attendance, only three members being absent. After luncheon at the Railway Hotel, Dewsbury, a special car conveyed the members to the Frost Hill depôt of the Yorkshire (W.D.) Tramways, Liversedge, where two cars had been fitted up for the purposes of the demonstration.

The first car taken out was No. 47, a car of the ordinary type which had been fitted with the self-winding spring brake, described in our issue of September 11th, 1908. A section of the car floor had been taken up, and the whole of the mechanical part of the brake was exposed to view. The first test consisted of an exhibition of the brake in descending Frost Hill from the depôt. The rails were in a very greasy state, and it was doubtful whether the wooden shoes with which the car was fitted would be more satisfactory on the track than iron shoes. However, the spring brake performed its duty easily and efficiently on the descent, which was accomplished at a speed of about 10 miles per hour, and the winding of the spring was done with perfect regularity. The brake is a substantial piece of mechanism in which the springs are wound by the momentum of the car; when fully wound the winding pawl or catch is automatically disengaged. A feature of the brake is that even though the winding may only just have been commenced when the car is started, the brake may be put into immediate use. The ascent of Huddersfield Road was commenced at a moderate speed, and when the car reached the steepest gradient—about one in nine—current was switched off, and the car was held by the brake, there being not the slightest suggestion of the car running back. In test No. 3 the car was taken to the top of the hill. Starting from rest, it descended the top part of the hill, which is about 1 in 12, and immediately it entered upon the second part, which is about 1 in 14, at a speed of 18 miles per hour, the track brake was put on, and the car stopped in 32 yd., neither sand nor wheel brake being used. In the next test the car started from rest and was allowed to attain a speed of 22 miles, when both brakes were applied, the car pulling up in the short space of 14 yd. It was pointed out by Mr. Goldston, the engineer who was superintending the demonstration, that the brake could be applied at any strength desired, the mere pulling of a hand lever bringing the brake into service. A very interesting feature was illustrated in the next test, when the car, which was travelling at about 16 miles per hour, was brought to a stop by the application of the brake from the back platform. The application of the self-winding spring brake from the front or the back is one in which each application is of service to the other; but in many of the ordinary tramcar brakes at present in use the application of the brake from one platform neutralises that from the other platform. This is looked upon as a decided improvement, and the ease with which the car was pulled up was apparent. One of the members desiring to see the effect of the brake on an unsanded portion of the track, the car was taken to the steepest gradient previously mentioned, and, having reached a speed of 12 miles, the brake was applied. The speed, of course, was not very high, but the brake pulled up the car in a very short distance (not measured) in a most satisfactory manner.

The second part of the demonstration took place upon car No. 7. The brake fitted to this car was a magnetic brake fitted with a mechanical attachment for putting it on by hand—really an ordinary mechanical track brake which could be used with a variable drag action so as to increase the power. Mr. Freund, who is the designer of this brake also, has styled it the Tumbler brake (self-tightening). The principle, briefly, is that a depression plate is fitted with cup-shaped housings for the shoulders of the tumbler, the latter resting on spherical pivots on the top of the brake shoes. Immediately the lever on the platform is pulled the tumbler tilts, allowing the shoe to drag. Another touch of the lever releases the brake. The shoes fitted to this brake provide for a certain amount of side play, and it is, therefore, claimed that the brake block finds its best possible "hold." The brake fitted to car No. 7 had been regulated to give four "notches" of drag—that is, four different degrees of the drag action—and in the first test the brake was applied notch by notch, so as to show the effect of the various amounts of drag. This test was watched with considerable interest, and the easy manner in which the brake was manipulated, and the faultless way in which notch succeeded notch without any appreciable jerk, were highly praised. In the next test, the speed was not much higher, but the brake was used as an emergency brake and the drag action went right over. It should be mentioned that this car was fitted with new iron shoes, and the opinion was expressed that quicker and better stops would doubtless be obtained if wooden shoes were used. In consequence of this, a wooden shoe was inserted—the process only taking about two minutes—and travelling at about the same speed, with one iron shoe and one wooden one, a quicker stop was obtained; the effect was a gentle and gradual pull up, and was not at all "uneasy." The general utility of the brake was admirably shown in a coast down the hill, and the smooth manipulation of it, coupled with its simplicity and the ease with which it was released, appeared to make a favourable impression upon the managers present. Mr. Goldston explained that, in adopting the "tumbler brake," the driver had, in reality, a double brake. The drag action was intended for coasting purposes, as well as for use as an emergency brake, and the mechanical action could take place before or after the magnetic. It had often been shown that the magnetic brake was apt to fail unexpectedly, and this difficulty was entirely overcome by using the "tumbler,"

inasmuch as the driver could apply the magnetic brake by hand, and he could intensify the mechanical effect by means of the drag.

Those tests in which the speeds were not indicated were taken at a speed of from 16 to 23 miles per hour, and the gradients on the portion of track where the majority of the trials took place were 1 in 12, 1 in 14, and down to 1 in 17.

Mr. Goldston appeared to be very well pleased with the excellent manner in which the brakes had worked under the circumstances, and was highly satisfied with the demonstration. In the course of a short chat with our local representative, he said he particularly wished it to be understood that car No. 7 had not been fitted up for the purpose of exhibiting quick stoppages. It had been fitted up simply and solely to show what the "Tumbler" brake could and would do. He was particularly well pleased with the "Tumbler" brake, and said that there were three advantages which appealed to him very much. The first was that the brake was an ordinary mechanical track brake, with equal power to those which they had on their cars and to those in general use all over the country. Secondly, the apparatus gave them the drag action, viz., the extra weight of the car on the blocks. Thirdly, the brake could be applied as an ordinary magnetic brake.

The managers who witnessed the demonstration also appeared to be favourably impressed. Several complimentary references were made to the brakes, especially with regard to the "Tumbler," and coming as they did from managers who, for the most part, are engaged in the West Riding of Yorkshire, where hills are the rule rather than the exception, they should prove of value to other tramway managers in the country. During the demonstration there was practically no criticism of an adverse character, and the general opinion appeared to be that the brake was sound in principle, and one which could be relied upon.

The managers were afterwards entertained at tea by the managing director of the company, and in the evening a private discussion took place upon the demonstration, and upon other tramway matters.

ELECTRIC LIGHT INSTALLATION ON THE STANNOS WIRING SYSTEM.

On Saturday last the students attending Mr. E. Kilburn Scott's lectures on Electrical Engineering Quantities and Estimates at the Northampton Institute visited the new factory and laboratory of Messrs. J. Fletcher-Fletcher & Co., Seven Sisters Road, to see the electric light installation and lift, &c. Mr. Rawlings, who had

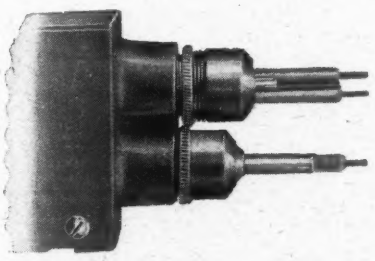


Fig. 1.—Box Fitted with Two Adapters, Taking One and Three Stannos Wires Respectively.

carried out the electric installation, was present to describe the details of the work and explain the many advantages of the Stannos wiring, which he has used. The installation is unique in that it illustrates the OS system of wiring for:—

1. A two-wire system.
2. A surface concentric system.
3. A water-tight concentric system with Kalkos fittings.
4. A combination of 2 and 3 in buried work.

Stannos wire is insulated with pure and vulcanised rubber, taped, and then wrapped round twice with a closely compressed sheet of tinned copper. On an earthed concentric system the outer copper carries the return current, and it has only about one-third of the resistance of No. 18 s.w.g. wire.

The supply for the lighting is taken from the Islington Corporation at 100 volts (or 200 if desired) alternating, single-phase, 50 cycles.

The mains, consisting of twin-armoured cable, pass from the Corporation fuses through an ironclad D.P. switch and fuse to the first floor, terminating at a Foster double-wound transformer giving 100 volts on the lamp side and 100 or 200 volts as desired on the supply side. The object of using a separately wound transformer is to isolate the installation so as to enable an earth return system to be used, besides affording facilities to alter the voltage. In conjunction with the transformer there is a Burston automatic switch to disconnect the primary circuit when no lamps are in use. Distribution from this point is made from a four-way board, one pole of which is connected to a bus-bar, forming the return of an earthed concentric system. From this point single cables drawn into Kalkos tubes are carried to four distributing boards, the tubes being connected to the earthed bus-bar. From the fuseboards, the OS system of wiring has been employed, using Stannos wire and fittings, together with the special continuity fixtures provided for concentric work. On the top floor, and a portion of the ground floor, the system has been made water-tight by soldering the Stannos wires into Kalkos boxes.

Fig. 2.—Grip for Stannos Wires.

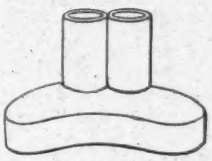


Fig. 3.—S K 2 Adapter.

In addition to the before-mentioned "earthed" system two pilot lights have been installed on the ground floor, two Stannos wires being used in the ordinary way without the intervention of the transformer.

The number of points installed is 180, with 121 switches, and the following material has been used:—1,800 yards Stannos single 1/18 and 3/20; 50 yards main cables; 2,500 O3 clips; 300 continuity fixtures; fittings for Kalkos boxes and Kalkos tubes, &c.

In addition to the lighting, there is a system of electric fire and burglar alarms worked from the 100-volt accumulators, which are used for the lift control. The wires leading from the accumulators run through fuses to the whole of the bells, terminating

Fig. 4.—Kalkos Box and Switch, with S K 2 Adapter.

at a relay. This portion of the wiring is carried out with Stannos wire, the wiring between the relay and the whole of the fire and burglar alarm points being carried out with ordinary high-class bell wire.

The bells which are used for timing (rung three times daily), together with the relay, batteries, &c., are the same as are used for the burglar and fire alarm system, thus ensuring their maintenance in good working condition.

The electric lift has been supplied by Messrs. Childs & Co., and is of special interest because, although the motor is single-phase, the control gear is worked by direct current from a Hart battery. In order to charge this battery an aluminium rectifier is employed. The push button for stopping has two contacts, the

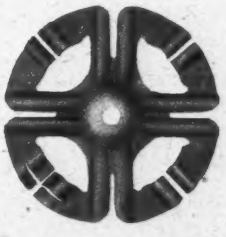


Fig. 5.—S E 2 Side Entry Continuity Fixture.

first putting the brake on through a resistance and the second putting it on direct. In this way the lift is brought to rest without any jerk.

As various improvements have been made in the OS wiring system since we first described it, the following particulars will probably be of interest to our readers. The ideal before the manufacturers (Messrs. Siemens Bros. & Co., Ltd.) has been to provide a system of wiring which shall be inexpensive, but efficient and durable, unobtrusive when used for surface wiring, but suitable also for concealed wiring, and possessing an electrically continuous earthed sheathing, which can be used also as the return conductor of a concentric system.

The Stannos wires can now be had insulated not only with vulcanised rubber, but also with a special dielectric called "Unval," which contains no sulphur; they are subjected to a test of 1,000 volts pressure, and both classes can be supplied with aluminium

taping under the sheathing, a type especially recommended for concentric wiring. It is interesting to note that the current-carrying capacity of the Stannos wires on the concentric system is greater than on the ordinary two-wire system, owing to the small pressure drop in the sheathing; thus a 3/20 wire carrying 6·4 amperes has a drop of 11·3 volts per 100 yards on the two-wire

Fig. 6.—Continuity Fixture for Back Entry of Wires.

system, but only 7·7 volts on the concentric system, while, of course, the latter costs little more than half as much as the former system. The importance of these points, especially in connection with low-voltage metallic-filament lamp installations fed from transformers, is obvious.

A variety of new accessories has been evolved for use with the O S system. Fig. 1, p. 767, shows two new adapters employed when Stannos wires are run into steel junction or fuse boxes; they are of

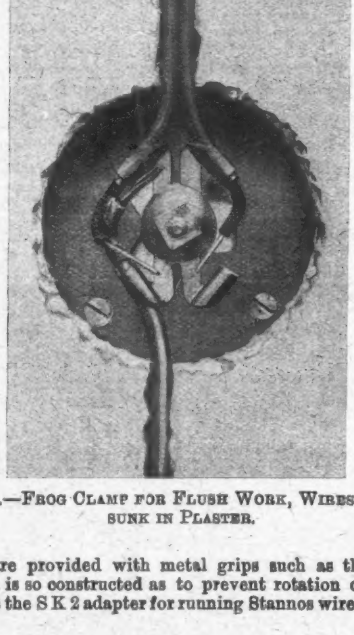


Fig. 7.—Frog Clamp for Flush Work, Wires shown sunk in Plaster.

brass, and are provided with metal grips such as that shown in fig. 2, which is so constructed as to prevent rotation of the wires. Fig. 3 shows the S K 2 adapter for running Stannos wires into Kalkos

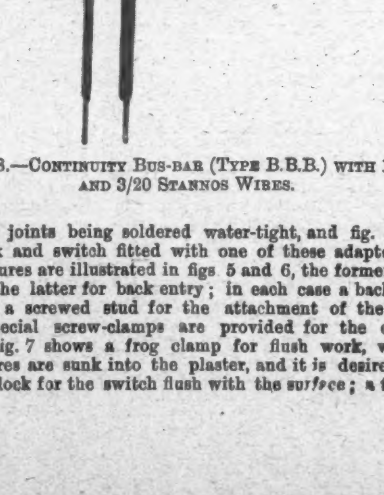


Fig. 8.—Continuity Bus-bar (Type B.B.B.) with 1/18 and 3/20 Stannos Wires.

boxes, the joints being soldered water-tight, and fig. 4 shows a Kalkos box and switch fitted with one of these adapters. Continuity fixtures are illustrated in figs 5 and 6, the former for side entry and the latter for back entry; in each case a back plate is used, with a screwed stud for the attachment of the earthing clamp. Special screw-clamps are provided for the concentric system. Fig. 7 shows a frog clamp for flush work, where the Stannos wires are sunk into the plaster, and it is desired to have the wood block for the switch flush with the *surface*; a temporary cap is placed over the wires after they have been fixed as shown, to preserve them from damage while the plastering is completed.

A continuity bus-bar for a fuseboard is illustrated in fig. 8; such bus-bars are made in various sizes. Lastly, fig. 9 shows a water-tight T joint-box for concentric work, with the component parts displayed and the jointed wires in position; these boxes are used where the ordinary continuity fixtures with steel covers would be too large or unsightly, and where it is desired to have the whole system water-tight. The wires are jointed with the aid of small

Fig. 9.—T Joint Box for Concentric Work, showing Parts and Method of Jointing Single Wire Circuit.

channels of soft metal, which are soldered together and to the wires: the joint, with two porcelain linings, is then laid in the soft-metal base, and the cover is soldered to the latter and to the outer sheathing of the wires. A hole is left in the cover to permit the air to escape when heated in the act of soldering, and is afterwards filled up with a screw, as shown.

Full particulars of these and other details, special tools, &c., are given in a recent catalogue (No. 517, Section I) issued by Messrs. Siemens Bros., which also contains instructions for the erection of the "Metacase" (Kuhlos and Stannos) conductors.

LEGAL.

Alleged False Trade Description.

The Proceedings Against the Welsbach Co.

(*Continued from page* 736.)

At Clerkenwell Police Court on Saturday, Mr. Bros heard further evidence on the adjourned summonses against the Welsbach Incandescent Gas Light Co., Ltd.

James Fletcher Young, manager of the electric light department of the General Electric Co., Ltd., said his firm acted as agents in this country for the Auer Gesellschaft Co., of Berlin. The first metal-filament lamps they had to deal with were the osmium lamps which were sent to them by the Auer Co. The metal-filament of these lamps was made of osmium. Then they had lamps the filament of which was made of tungsten or wolfram. Afterwards they imported the Osram lamps from the Auer Co. They first began to receive these at the end of 1906. Some of these still came from Germany, although some were manufactured in this country in a factory, which was erected after the passing of the new Patents Act. The General Electric Co. was the only firm selling Osram lamps in this country, and their sale had assumed very large proportions. When the Osram lamps were first introduced, they bore the name of the Auer Gesellschaft Co. The osmium lamp was invented by Baron von Welsbach, and as far as he knew no other metal-filament lamp was invented by him.

A copy of an advertisement of the defendants' lamps was placed in the witness's hands, and Mr. Rufus Isaacs asked him what effect it would have on his mind. Witness: I should consider that the lamps offered were the invention of Baron von Welsbach, or the output of the Auer Co.

Mr. Isaacs: Do you know of any electric lamp invented by Baron von Welsbach sold with the trade mark "Aur" upon it?—No.

What would be the effect of stamping these lamps with the words "Aur" and "Welsbach"?—It would lead people to believe that they were the product of the Auer Co., or, as it is sometimes known in this country, the German Welsbach Co.

So far as you know, had Baron von Welsbach, or the Auer Co., anything to do with that lamp?—No. Nothing whatever.

Mr. Walter: You know there are three Welsbach companies in Europe, the German, the Austrian and the English?—I believe so.

Are you aware that 98 per cent. of the shares of the Austrian company are the property of the English company?—No.

Are you aware that the policy of the Welsbach companies has been not to use the words "Welsbach" and "Aur" in the territories of the others?—No.

Are you aware that the trade marks "Auroslamp" and "Auer-osmi" were applied for by the German company for their lamp?—No.

Are you aware that the Austrian company, at the instigation of the English company, objected to that registration?—No. I am not aware of it.

In reply to further questions, Witness said he believed the German company undertook for a certain period not to use the

word "Auer" in connection with incandescent gas mantles, but he believed that period had now expired. The registered trade mark of the German company for incandescent gas mantles was "Dagea." The word "Auergesellschaft" had formed part of the name of the German company as long as he had known it, which was two and a half years.

Mr. Walter: During the last two and a half years has a single advertisement been issued by your company in which the word "Auergesellschaft" appears?—Not by our company.

With the exception of the one circular in evidence, have your company ever advertised the word "Auer" in connection with the lamps?—No.

Baron von Welsbach has nothing to do either as manufacturer or inventor with the Osram lamp?—Not as far as I know.

A certified copy of the Patents Register was handed to the witness, and he said he saw by that that since January, 1899, the defendant company had had the trade mark "Aur" registered for goods in class 13. He was not aware that the trade mark "Aur" had been used upon all the goods sold by the Welsbach Co. for many years.

Mr. Walter: Are you aware that the word "Aur" upon goods in this country commonly means that they are the goods of the Welsbach Co?—I am not prepared to deny it.

Is the word "Welsbach" largely used upon the merchandise of the Welsbach Co.?—I do not know.

Are you prepared to deny that the word "Welsbach" upon goods in this country commonly means the merchandise of the Welsbach Co.?—On electric goods I should deny it.

Witness said the osmium lamps were not capable of being made for use on high voltage circuits, and they were not so successful commercially as the Osram lamps.

Mr. Walter: Has the word "Welsbach" ever been used in an advertisement in connection with the Osram lamp?—Yes. In reprints from the *Standard* and *Daily Telegraph*.

Mr. Walter read extracts from these reprints, in which it was stated that Dr. Auer, of Welsbach, who invented the first incandescent gas mantle, also invented the first metal-filament lamp. He asked the witness if the word "Auer" had appeared in any of his advertisements of Osram lamps. Witness: No, not in trade advertisements.

Re-examined by Mr. Rufus Isaacs, Witness said there was a reference to the Auergesellschaft Co. on the printed wrapper in which the osmium lamps were sold.

The case was adjourned until November 20th.

Woolf *v.* London United Tramways Co.

In the King's Bench Division on Monday and Tuesday, November 8th and 9th, before Mr. Justice Bucknill and a common jury, an action was tried in which Mrs. Nina Woolf, a dressmaker, of Stoke Newington, sued the London United Tramways, Ltd., for damage for personal injuries alleged to have been sustained in consequence of the defendant company's negligence in failing to keep the roadway along which the line runs in a fit and proper and safe condition for vehicular traffic.

Mr. Ralph Bankes was counsel for the plaintiff, and Mr. Roskill, K.C., and Mr. Glasgow appeared for the defendant company.

It appeared that defendant was one of a party who on Whit-Monday of last year were proceeding by a four-horse brake from Stoke Newington to Hurst Park to witness the races, when, opposite Christchurch schools in the High Road, Chiswick, the brake collapsed, and its occupants were thrown out into the road, plaintiff being somewhat seriously injured. She alleged that the accident was due to the wheel of the brake dropping into a hole in the roadway and thus being wrenched off; and the defence was that, on the contrary, it was caused by the rotten condition of the vehicle itself. Evidence on either side was called, and his Lordship, in summing up, instructed the jury that the onus of proof rested upon the plaintiff. Parliament had laid upon the tram company the obligation to keep the highway in a fit and proper state to enable it to be used by the public with safety, and she had to prove that they had failed to fulfil this obligation and that it was in consequence of such negligence that the accident occurred. Of course, as men of the world, the jury would say the company were not bound to keep the road as level as a billiard table; and they must be satisfied that at the particular spot where the accident occurred, the state of the tramway was dangerous for the public passing over. If they thought the brake was in a rotten condition, it would be a matter for their grave consideration and judgment whether there was a hole in the roadway into which if the wheel dropped it would have broken it off, even if it was sound.

The jury found a verdict for the defendant company; and, upon his Lordship's suggestion, approved by the jury, they did not ask for costs; and judgment was entered for them without costs.

Bristol Gas Co. *v.* The Bristol Tramway and Carriage Co., Ltd.

In the Court of Appeal on Tuesday, Lord Justice Buckley, Lord Justice Kennedy, and Mr. Justice Swinfen Eady had before them the case of the Bristol Gas Co. *v.* the Bristol Tramway and Carriage Co., Ltd., which was an appeal by the defendants from a decision of Mr. Justice Phillimore, affirming the award of the arbitrator, Mr. Allen C. Edwards, appointed under the Tramways Act, 1870, to settle a dispute which had arisen between the Bristol Gas Co., and the Bristol Tramway Co., Ltd., in regard to Sec. 32 of the Act. That section provides that the construction of a tramway shall not interfere with the rights of local and road authorities or gas, water or electric light companies to deal with the roads for the purpose of repairing, laying down or removing mains, pipes, &c., giving notice of their intention to do so when the contemplated work will interfere with the traffic or affect the tramway, and sub-Sec. 5 provides that any extra expense in doing such work caused by the existence of the tramway shall be borne by the tramway company. In the present case the gas company alleged that by reason of the tramlines having been laid over the gas mains, the company had incurred additional expense in obtaining access to and altering their service pipes; such additional expense for the period between February 16th, 1905, and December 26th, 1906, amounting to £115 8s. The tramway company having refused to pay this demand, the gas company applied to the Board of Trade under Sec. 33 to appoint an arbitrator. Mr. Edwards was selected, and he undertook the reference without prejudice to the contention of the tramway company that no such "difference" had arisen as was contemplated by Sec. 33. Detailed particulars of the claim were furnished, and for the purpose of his award the arbitrator divided them into three classes. (1) Laying down a new service pipe and connecting it for the first time since the construction of the tramway with a main laid before the construction, amounting altogether to £63 19s. 8d. (2) Repairing, altering or removing a service pipe laid since the construction of the tramway; the main having been laid before such construction, £14 1s. 8d. (3) Repairing, altering or removing a service pipe or main laid before the tramway was constructed, £37 16s. 8d. The arbitrator held that with regard to the first class, the gas company was not entitled to the extra expense of laying the new service, but to one-third of the amount claimed; this being the agreed proportion of the total applicable to connecting with the old main as distinguished from laying the new pipe. He therefore awarded them £21 6s. 6d. With regard to the second class, he held that the gas company were not entitled to the amount claimed. As to the third class, the gas company were entitled to the £37 16s. 8d., and he directed the tramway company to pay the costs of the arbitration. It was contended by the gas company that they were entitled to the whole amount claimed. On behalf of the tramway company, it was contended that the only work for which expenditure could be claimed, was that which caused an interruption of the tramway traffic, and that the arbitrator was wrong in holding that any trifling delay shown to have taken place was such an interruption of traffic, as was contemplated by the section, and that no such claim by the gas company for additional expense was founded. Mr. Justice Phillimore confirmed the arbitrator's award and dismissed the appeal, but without costs. Hence the present appeal of the tramway company.

Mr. Balfour Browne, K.C., Mr. Simon, K.C., and Mr. Murphy, appeared for the tramway company; and Sir A. Cripps, K.C., Mr. Bethune, and Mr. Weatherley for the gas company.

Mr. Balfour Browne, for the tramway company, said the question raised was as to the proper construction of Sec. 32 of the Act of 1870. Before that Act was passed, various private Acts had been passed allowing water companies, gas companies, and electric light companies to use the streets or roads for the purpose of laying down their pipes or mains to supply gas, water or electricity to the public, and it was necessary when the Tramways Act was passed to see that the tramway companies did nothing to take away the rights which had been conceded by Parliament to those various bodies. Sec. 32 of the Act of 1870 dealt with the relations between those various bodies and the tramway companies. The important words upon which he relied were "such works whereby the traffic on the tramway will be interrupted." The contemplation of the Legislature was that, if the work to be done was really serious work, interrupting the passage of the cars along the tramlines, the tramway companies were to be responsible for the expense of the work. He submitted that the expenses which had been put upon the tramway company in the present case were not incurred in respect of work which interrupted the traffic on the tramway, and therefore, having regard to the construction of Sec. 32, the tramway company could not be held liable for the expense. The Legislature said, "Here are two public bodies in the road, both doing public service. If the work to be done on the road is a small matter which might have occurred whether the tramways were there or not, the gas company shall pay it. If it is a big matter which interrupts the tramways, the tramway company shall pay it." The learned counsel, proceeding, said there was no need to give the tramway company notice if the work to be done did not affect their traffic. It would only be a wasting of the time of the tramway engineer to give the tramway company notice of such matters as were set out in the gas companies' claim. If in the old days of horse-drawn cars the gas company had dug a trench between the two rails the traffic would have been stopped, because the horses could not then run over that part of the road, but nowadays with overhead traction a hole between the rails did not matter, because the cars could run over that, and there would be no interruption of traffic.

Mr Simon, K.C., who followed on the same side, said the point was of great practical importance, because the claims made here were for very small amounts and were numerous. He submitted that what was referred to in the proviso of Sub-sec. 5 of Clause 32 of the Act was a class of expenses which was limited in several ways. The pulling up of a gutter would not affect the tramways at all. The scheme of the section was that the gas water and other companies might go on doing their work on the road as before the Act was passed, but in so far as the work they wanted to do was work which would interrupt the tramway traffic they must give notice, and in so far as the work which interrupted the tramways was work which would immediately affect its stability, it had not only to be done under notice, but it had been done under superintendence. It seemed a very strange thing if the

Legislature really meant that a tramway company, which was doing useful public work, had to pay all those 2½d. charges which extended back to 1903. There were over 200 cases.

Mr. Cripps, K.C., for the gas company, said that it had been found by the arbitrator that every subject matter of the claim was in respect of works of which a proper notice had been given. He could not agree that "interruption" necessarily meant total stoppage. "Interruption" was rather a question of fact than of law. He submitted that the tramway company took an absolutely wrong view as to the construction of the Act.

Lord Justice Buckley, in giving judgment, said that in his opinion the appeal failed. The second question in the case was, "Do the facts proved in this case, which are admitted, constitute in law 'interruption' within the means of Sub-sec. 2 of Sec. 32 of the Tramways Act, 1870." After referring to the statement of facts in this case, his Lordship said it seemed to him that there had been an interruption by reason of the fact that in one instance, until the doing of the work in question, the tramway company had been in possession of two lines of tramways, and were, by the events which happened, deprived of the use of one of the lines, and obliged for the whole day to carry on the traffic on one line only. In his opinion that constituted an interruption. He further thought that there was an interruption in this that the workmen in the trenches were in a position of danger when the tramcars approached, and that the tramcars had to come to a standstill or at least to slow down to enable the workmen to get out of the trenches. In his judgment, there was interruption within the meaning of the sub-section. As to the third question in the case, he was of opinion that the notices served by the gas company were proper notices and sufficiently complied with the section. Under those circumstances it was obvious that the other questions in the case did not arise. But the arbitrator had answered the first question: "Does the proviso in Sub-sec. 5 of Sec. 32 of the Act of 1870 apply if the work claimed for does not cause an interruption of tramway traffic within the meaning of the Sub-sec. 2." The arbitrator had answered the first question in the affirmative. His Lordship would not refrain from expressing his opinion on that question. He thought "such work" in Sub-sec. 2 and Sub-sec. 5 meant work whereby the traffic on the tramway would be interrupted. In his opinion the answer to the first question should have been in the negative. He was also of opinion that the connecting of the new service pipes with the old mains was an alteration of the mains.

Lord Justice Kennedy and Mr. Justice Swinfen Eady concurred.

The appeal was accordingly dismissed with costs.

In *re* Medhurst—Morris *v.* Brewer.

In the Chancery Division on Friday last, Mr. Justice Parker had before him a motion in *re* Medhurst—Morris *v.* Brewer, by which the plaintiff asked for the appointment of receiver of the electrical engineeer's business carried on by the late Francis Hastings Medhurst, and other property.

Mr. Percy Vaughan, in support of the motion, explained that Mr. Medhurst, who was prospective Unionist candidate for Stafford and who committed suicide at Croydon on October 26th last, had mortgaged to the plaintiff his electrical engineer's business, together with a policy of insurance for £3,000. Beyond the property mortgaged to the plaintiff, the estate consisted of some securities and furniture, part of the furniture having been seized during the testator's lifetime under a distress for rent, and the remainder was now warehoused. The estate was very much embarrassed, and proceedings by creditors were pending. Under these circumstances, counsel asked that a receiver might be appointed of the property comprised in the plaintiff's mortgage on the ground that the security was in jeopardy.

Mr. Bennett said that he appeared for the two persons named in the testator's will as executors, who had been made defendants. One of them had actually signed a renunciation of probate, and the other either had renounced or was going to renounce. That being so, they had not filed any evidence in opposition to the motion, but he suggested that no receiver was necessary. The testator's assets, apart from the business and the insurance policy, consisted of some share certificates and the warehoused furniture. The share certificates were in the hands of solicitors, and were perfectly safe, and the furniture would not be dealt with.

His Lordship asked what was the value of the estate.

Mr. Bennett said about £1,000. The plaintiff's mortgage, which was dated in 1897, gave a charge on the business and the policy of insurance. The policy was in no way in jeopardy, and Mr. Brewer, who was taken into partnership by the testator in 1908, was perfectly willing to act as receiver for the purpose of getting in the book debts, &c.

Mr. Hansall said he represented a creditor for £30,000, and he suggested that the estate, which was insolvent, should be administered in bankruptcy. He understood that some of the creditors were applying for administration of the will annexed.

Mr. Justice Parker thought that the plaintiff was entitled to have a receiver of the property comprised in his security. That was all he could do at present. There being the necessary affidavits of fitness, he would appoint the gentleman named in the notice of motion with liberty to him to act at once, but the plaintiff must undertake to accept short notice of motion to discharge the appointment when a proper legal personal representative of the estate had been appointed.

Irving *v.* Bodie.

In the Courts of Justice on Thursday last week, Mr. Chas. Henry Irving, the son of a Cumberland farmer, obtained £1,000 damages against Mr. Samuel Murphy Bodie, known on the music-hall stage as "Dr. Walford Bodie, medical electrician, hypnotist, bloodless surgeon," &c. Irving had apprenticed himself to defendant to learn the cure of diseases by electricity, &c., and had paid £1,000 for his apprenticeship. After some time, however, he came to the conclusion that defendant had misrepresented to him his powers, and he came before Mr. Justice Darling and a common jury in the King's Bench Division, asking for the return of his money. During the hearing some remarkable evidence was given from an electrical point of view. Among other things, Bodie claimed to have the power of withstanding enormous currents of electricity through his body, amounting, as he told his Lordship, to "millions of volts." "My treatment," said Bodie in the box "is electricity, which reanimates and brings back fresh life to the muscles."

Mr. Powell, K.C. (for the defence): Is it a fact that you sustain a current of many thousands of volts?—Defendant: As many as you like—millions if you like.

His Lordship: Do you say million or millions?—Defendant: I am prepared to sustain millions to-day to save my honour.

His Lordship: Is this a special property of yours, or is it common to most people?—Defendant: It is quite common; the higher voltage diminishes the danger. I am speaking of high-frequency current. Defendant added that he had sustained 60,000 volts of intermittent current—a quantity no one else had ever come near sustaining except the plaintiff.

His Lordship: How many amperes are you using?—Defendant said he had had as much as 20 amperes.

Mr. Powell: Have you studied electricity and obtained a knowledge of it?—Defendant: A little.

Defending counsel applied to his Lordship for permission to allow "Dr." Bodie to give a demonstration of his powers in one of the private rooms in the Courts, and this request Mr. Justice Darling acceded to, on terms that a qualified electrician appointed by himself should be present to give his opinion afterwards in the witness box.

After the demonstration had taken place, Mr. Arthur Strich, of the Sanitas Electric Co., went into the box, and stated that defendant had a 12-volt accumulator from which he obtained his current, and by means of a transformer and coil, changed it to a higher voltage. The coil was made to give a 12-in. spark, but as a matter of fact, it only gave a 6-in. spark. Defendant took about 30,000 volts intermittent current. Witness could have done it himself if he had trained himself at all to take large quantities of electricity. There was no risk of life in the amount of current defendant sustained.

Other evidence was given with reference to a "Cage of Death." Defendant, on the stage, got inside a large wire cage which was electrified, and holding iron bars in his hands touched the sides of the cage, causing a great deal of sparking. Evidence for plaintiff was given to show that here again a high-frequency machine was used, which rendered the "Cage of Death" quite safe, and a member of Messrs. Cox Bros., the medical electrical apparatus makers, gave evidence of supplying defendant with some of his "plant."

BUSINESS NOTES.

Book Notices.—*Gas Works Directory and Statistics.* 1909-10. London: Hazell, Watson & Viney, Ltd. 10s. 6d.—This is the thirty-second edition of this work, revised up to August, 1909. Full particulars appear in three sections of the gas undertakings in England and Wales, Scotland and Ireland respectively. The name of town, population, owner of system, capital, price per thousand, number of consumers, number of public lamps, personnel, &c., are clearly stated, and where there is an electricity supply system that fact is indicated also.

"The Physical Review," Double Number, Vol. XXIX, No. 3. September, 1909. London: McMillan & Co., Ltd.

"Science Abstracts," Sections A and B, Vol. 12, Part 10. London: E. & F. N. Spon, Ltd. Price 1s. 6d. each part.

"Health in the Home." By J. Johnston, M.D. Manchester: John Heywood, Ltd., Deansgate. Price 6d. net.

"Electric Power Conductors." By W. A. Del Mar. London: Crosby Lockwood & Son. 1909. Price 9s. net.

"Electrical Inventions, and the Training of the Electrical Engineer." Lecture delivered before the Faculty of Engineering of University College, London, October 6th, 1909. By Prof. J. A. Fleming. London: *Engineering*.

"Motor Manual." Twelfth edition. London: Temple Press, Ltd. 1909. Price 1s. 6d. net.

Private Meeting.—Harold Downer, 110, High Street, Watford, electrical engineer.—A meeting of the creditors herein was held on November 1st, when a statement of affairs was submitted, showing liabilities amounting to £405. Of that amount £329 was due to sundry unsecured creditors, the balance of £75 being in respect of cash claims. There were preferential claims for £28, and, after providing for these, the assets were estimated to realise £548, the estate thus showing a surplus of over £140. The assets were as follows:—Stock in trade, £109; book debts estimated

to realise £263; work on hand, £80; cash at bank, 5s. 1d.; fixtures and fittings, £25; household furniture, £50; and investment in building society, £48. It was stated that the debtor started trading for himself with little or no capital in December, 1889. He had made a net average profit of about £200 per annum, while his drawings had also been in the neighbourhood of that figure. Proceedings had been commenced against the debtor by a creditor, and acting on the advice of his solicitor, the debtor executed a deed of assignment. The stock in trade had been valued by the debtor, and after a lengthy discussion, it was resolved that the meeting should be adjourned for an independent investigation to be made by the nominee of the principal creditor.

Bankruptcy Proceedings.—Ernest Goodman (trading as E. Goodman & Co.), electrical engineer, 30, Hertford Street, Coventry.—The receiving order in this case was made on debtor's petition, and according to the accounts filed, the unsecured liabilities amount to £198, and the assets are estimated at £36 net, a deficiency being shown of £162. It would appear that the debtor started business in March, 1908, with about £400 capital at the above address. A meeting of creditors was held last September, when the statement of affairs presented showed a deficiency of £127. A composition of 10s. in the £ was offered and accepted by the creditors, subject to debtor being able to find satisfactory guarantees, but this the debtor was not able to do, and on October 6th he executed an assignment. Debtor ascribes his failure to bad trade and losses on contracts. The books kept appear to be debit and credit ledgers. The unsecured liabilities, with the exception of about £3 for personal expenses, appear to be trade debts. First meeting, November 15th; public examination, December 6th, both at Coventry.

Samuel Emerson Smith, electrical engineer, 271, High Street, Lincoln.—The first meeting of the creditors in this case was held last week at the Official Receiver's offices, 10, Bank Street, Lincoln, and later on the same day the debtor attended the Sessions House, Lincoln, for his public examination before Mr. Registrar Stephen. The liabilities were stated at £125, and the assets were estimated to realise £220, an estimated surplus of about £94 being shown. Debtor stated that the cause of his failure was the illegal seisure of his goods and machinery. Mr. E. E. Tweed (Lincoln) appeared for the petitioning creditor, and Mr. G. L. Hazlehurst (Lincoln) for the debtor. In reply to the Official Receiver (Mr. F. C. Brogden), debtor stated that he was now employed by "Smith's Electrical Co." He started business in 1903 under the title of A. Smith and Co., but made an assignment in November of the following year. A trustee was appointed, and to the best of his recollection his liabilities were £400 odd. He never knew or inquired what dividend was paid. He next managed the business for his wife under the style of A. C. Smith, her name being Ada Cooper Smith. He was manager and received £2 a week. Then A. C. Smith, Lincoln, Engineers, Ltd., was established, this being the same business turned into a limited liability company. He held 500 shares, practically the whole. In November last this concern got into difficulties, a receiver being appointed, and debtor did not think it was quite wound up yet. Smith's Electrical Co. and the Ados Co. followed, and in these "the usual seven" were concerned. The Ados Co. also got into difficulties, and A. C. Smith and "Ados" had been realised. Smith's Electrical Co., of which he was manager and his wife secretary, was still going on. The case stands adjourned.

W. T. Harris, electrical engineer, Commercial Road, Portsmouth.—November 22nd is the last day for receipt of proofs for intended dividend to reach the trustee, Mr. E. W. C. Whittaker, 3, Portland Street, Southampton.

C. Scott Snell, civil engineer, Westminster.—An order of discharge was applied for on July 19th. Mr. Registrar Linklater suspended the discharge for two years and six months.

Consular Notes.—Paraguay.—H.M. Consul at Asuncion reports that seven new telegraph stations were opened to the public in Paraguay during 1908, viz., at Santiago, San Cosme, Carmen del Parana, Encarnacion, Ipane, Jbapobo and San José-mi. A double wire has also been stretched between Tebicuary and Villa Florida, and between Manduvira and Concepcion. A line is, moreover, being constructed to unite Puerto Max, the most northern telegraph station at present in the Republic, with Bahia Negra, still further north.

China.—H.M. Consul at Shanghai reports that the inauguration of the electric tramways in the International and French settlements took place in the spring of 1908. The two systems, which were contracted for and laid by a British company, traverse all the principal thoroughfares of the two settlements. The new form of locomotion became at once very popular among the Chinese, and has proved an immense boon to the inhabitants of the settlements. When the two system are linked together, as is projected within the next few months, it will be possible to reach all parts of the settlement from the native city, and a large increase in earnings is certain.

Servia.—The Belgian Minister at Belgrade, in an admirable report on the conditions of the electrical trade in Servia, states that it was the Société Belge de Tramways et d'Electricité, which about 1903 initiated electrical installation work in Servia by building a large power station to serve the tramways and the public and private lighting. Since then several other towns have had recourse to electricity for public and private lighting, viz., Nisch, Schabatz, Leskovatz, Ujitze and Valjevo. At Valjevo there are two concessionaires: a German, Herr Julian Schmidt; and an Englishman, Mr. Finay. The works at Nisch are exploited by the municipality; those at Leskovatz were installed by a Servian company, as were also those at Ujitze and Schabatz. A Servian company was on the point of being formed at Tchatchak to erect electrical works there for the utilisation of the forces of the River Morava, but the project has been abandoned for the moment, owing to the lack of competent technical engineers. Besides the works named, there exist only those built by the State (for telephones and telegraphs), and some private enterprises at Belgrade which produce electricity for their own use. In the provinces electricity is used in several mines, *e.g.*, at Bor (a French company), at Segue (Government mines), at Alexinatz (a Belgian company), at Maydan Pek (a Belgian company), and at Baba (a Swedish company). The restricted use of electricity for power purposes and lighting explains the smallness of the trade in electrical appliances up to the present. The official statistics do not permit of quotation of the imports prior to 1906, as before that year they were not shown separately. Since 1906, however, the imports have risen from 438,858 fr. to 615,362 fr. in 1907 (the figures for 1908 are not yet available). Taking the various classes of goods separately, it is found that the dynamos most in demand are those of from 10 to 50 kw., the price of a 20-kw. dynamo delivered in Servia free, including Customs duties, being given at 2,200 fr., with an addition of 90 fr. for the regulator, &c. Motors and dynamos of low powers (according to the report) are best supplied by Germany, but Belgium can do a good trade in higher power machines. The duty on dynamos, alternators, and other electric motors with their accessories and detached parts is 12 fr. per 100 kg. (if weighing more than 3,000 kg.), 17 fr. per 100 kg. (if weighing from 500 to 3,000 kg.), and 22 fr. per 100 kg. (if weighing less than 500 kg.) In 1907 the total importation of dynamos was 168,677 fr., of which Germany supplied 84,145 fr., Austria 73,672 fr., and Belgium 2,800 fr. The accumulators best adapted for the market are those with a capacity of 580 ampere-hours, of which the price is quoted at 150 fr. (port dues and Customs charges included). The imports in 1907 were 46,033 fr., of which 39,217 fr. were supplied by Austria. The duty is 20 fr. per 100 kg. The supplies of wire and insulated cables are for the State and central stations, and Germany holds practically a monopoly with 151,024 fr. out of a total of 156,056 fr.; the duty is 20 fr. per 100 kg. The largest trade is in heavy wires and cables protected by metallic coverings. The imports of electrical appliances of various kinds amounted to 72,286 fr. in 1907, of which Germany supplied 28,819 fr. and Austria 31,093 fr. A duty of 60 fr. per 100 kg. is levied on telegraph and telephone apparatus, electric bell apparatus, microphones, battery elements, and a duty of 75 fr. per 100 kg. on electric meters, interrupters, rheostats, &c. The arc lamps most in demand are those for continuous current of 5 amperes, 10-11 hours, of which the price is 90 fr. (port dues and Customs charges included). In 1907, 17,831 fr. worth of lamps were imported, of which Germany supplied 9,847 fr. and Austria 7,281 fr. The duty is 60 fr. per 100 kg., and a good opening for trade exists even with this duty. Electric carbons were imported in 1907 to a value of 11,540 fr., of which Germany supplied 4,877 fr. and Austria 4,904 fr. The duty is 30 fr. per 100 kg. The class most in demand is that valued at 55 fr. per 100 metres (port dues and Customs charges included), and selling at 18 fr. per 100 pairs of 200 mm. length each. Incandescent lamps and other similar lamps were imported to a value of 26,294 fr., of which Germany supplied 11,931 fr., and Austria 8,891 fr. As to price, the lamps consuming 3·6 watts per candle are sold at 60 centimes each, and those consuming 1 watt per candle at 4 fr. each. The duty payable is 150 fr. per 100 kg. The official statistics do not give details as to heating apparatus but supplies are chiefly from Germany, except those used for heating tramcars which are supplied by America. Firing and explosion apparatus which are frequently seen on the market, ventilators, &c., were imported to a value of 7,050 fr. in 1907, Austria supplying 3,065 fr. and Germany 3,339 fr. Electric ventilators are in demand for hotels and restaurants and are subject to a duty of 150 fr. per 100 kg. Electro-therapeutic goods are sold only to Dr. Farkitch who has an establishment at Kalimegdan, and has received a concession for another establishment at Vrutse. Various houses in Servia are engaged in the installation of electric lighting in private property, and supply the necessary apparatus. The chief are Slutzki & Co., Savitch & Co., and Christitch, at La Therasia; the Maison Ristitch, rue du Prince Michel, Belgrade; S. Yovanovitch & Bros., rue du Kolaratz, Belgrade: and Viktorovitch Bros., of Belgrade. The various accessories for electric lighting, such as shades for lamps, lamp globes, fusible interrupters, safety apparatus, insulating material, &c., are dutiable at the rate of 120 fr. per 100 kg., or 75 fr. per 100 kg. The value of the imports of this class in 1907 was 58,377 fr., of which Germany supplied 34,491 fr., and Austria 21,950 fr. There is no establishment in Belgrade dealing with repairs to dynamos effectively. Such repairs are seen to by the works themselves, or by the suppliers. The foreign houses which supply electrical materials to Servia are very numerous, and the keen competition which is thus made necessary has had the effect of reducing prices, which are often lower than the prices of the same goods in the country of production. In order to obtain trade it is necessary not only to supply articles of good quality at cheap rates, but also personally to solicit orders with activity, and to offer generous terms of payment. If it is hoped to gain an advantage over German and Austrian houses, the particular needs of the market must be carefully studied by the manufacturer himself, or by his representative. It is certain that the local buyer will not be induced to trade through a catalogue merely, but when his attention is drawn to the catalogue by a reliable agent, and explanations and concessions are given, there is every reason to believe that he may become a purchaser. The Servian houses interested in the trade have already been enumerated. All of them represent foreign manufacturers, and in some cases they

represent many. A useful method of introducing electrical goods would be to establish in Servia a warehouse for the exhibition of various specialities. If this warehouse prospered, a technical office could be added to study on the spot the various projects for electrical undertakings, which the development of the country is bound to produce. Up to the present, no office of this nature exists, and in the opinion of a Servian engineer, such an office would find considerable success, and might result in the establishment of works for the production of electrical materials in Servia. In accordance with a Servian law, new industrial undertakings of this nature are given many concessions in the matter of duties, &c., and a certain preference is given to the goods produced. In fact, the public departments, who are the largest buyers of electrical goods, must buy from the concessionaires of such works at standard prices. One of the essential conditions of success in business in Servia is the granting of long terms of credit. Capital is rare, and interest on money is high. It therefore becomes necessary for the purchasers to pay for the goods they buy at the time when they sell them again, and the manufacturers who have been prepared to be generous in this matter have been those who have succeeded in establishing themselves on the market. Austro-Hungarian manufacturers, in particular, grant three, six, nine and even 12 months' credit, and they have rarely suffered from the insolvency of their debtors. Their associations with the market make it possible for them to know at once the financial standing and reliability of the firms with which they deal, and they are thus enabled to carry on their trade without serious risks. The Germans, too, have appreciated the importance of the matter, and now give as long credits as those given by the Austrians, with very satisfactory results. In this respect English manufacturers are much to be blamed, since in many cases they even demand payment in advance. Care, of course, must be taken in giving credit, but if the ordinary precautions are seen to there is no reason why there should be any great risk attached to the trade. The usual credits in the electrical trade are from four to six months. The great success which the Austrians have attained is all the more extraordinary when one takes into account the fact that not being entitled to most-favoured-nation-treatment the duties leviable on their goods are in many cases 50 per cent. higher than those levied on similar goods imported from the other competing countries.

Austrian Cable Syndicate.—It is reported from Vienna that the cable-makers in Austria have concluded a price convention, and increased quotations by 10 per cent. Negotiations are still proceeding in respect of regulating the production by the fixing of tonnage allotments for each firm.

Industrial Progress in South China.—The South China Government has placed an order for a complete shoe factory in America, also a complete tannery and belt, harness and saddle factory in England, the equipment of which is being purchased through Messrs. Sanders, Rehders & Co., Ltd., London.

Catalogues and Lists.—The Langdon-Davies Motor Co., Ltd., Southwark Works, Deverell Street, London, S.E.—New set of price sheets giving revised prices and sizes of their polyphase motors of 50 periodicity, and single-phase motors of 40, 50, 60, and 80 to 100 periodicities. Since the last lists were issued several new intermediate sizes, also larger sizes, have been added.

Maschinenfabrik Augsburg-Nürnberg, A.G., Caxton House, Westminster, S.W.—Three new pamphlets containing full descriptive information, with line and half-toned illustrations, regarding the M.A.N. Diesel oil engines, and tabulated sizes, powers, speeds, &c., of single, two, three and four-cylinder engines. One of the lists contains tabulated particulars showing the numerous users of these engines on the Continent and elsewhere. It is stated that 1,600 of these engines, aggregating 145,000 B.H.P., have been supplied.

Messrs. Mackey's Electric Lamp Co., Ltd., Tulip Place, Bermondsey, S.E.—Eight-page illustrated price list of Mackey's "Metalux" metal-filament lamps with various shaped bulbs including ordinary, pear-shaped, crinkled tubular, and other fancy lamps, as well as traction, shop, dock and street lighting lamps.

Messrs. David Shanks & Co, Ltd, 58, Albert Road, Aston, Birmingham.—40-page catalogue of electric fittings. A large number of very pleasing designs of brackets, pendants, hall lamps, shade lights, counter-weight pendants, electroliers, table standards, &c., are effectively shown on art paper, prices appearing beneath each illustration. Some cast-iron water-tight fittings are shown in the closing pages.

Messrs. Thos. Broadbent & Sons, Ltd., Central Ironworks, Huddersfield.—With the title of "More Cranes," the firm has issued a 64-page catalogue of finely produced half-tone views of cranes manufactured by them, and of the works in which they are made, and of the offices at Huddersfield. A few pages of tabular matter show the principal dimensions, weights, &c., of their standard three-motor cranes, and in the other sections pictures appear of multi-motor, single-motor and miscellaneous cranes, supplied by them for electric power houses, steel foundries, engineering and other factories, rolling mills, railway shops, cable works and so forth. The miscellaneous section depicts hand-power, walking-jib, cantilever, warehouse and other cranes.

Messrs. Adams Manufacturing Co., Ltd., Bedford.—New catalogue ("B") of 40 pages, in which they illustrate and fully describe their "Igranic" ironclad pillar-type panels. Detailed prices are clearly tabulated. Many combinations are included, meeting the requirements of the Home Office and local authorities.

Messrs. Simplex Conduits, Ltd., Garrison Lane, Birmingham.—Two new catalogues dealing respectively with electric heating and electric cooking manufactures. The heating list (Section H) contains illustrations of a large number of designs of luminous radiators, and radiator lamps, also convector heaters, a number of them being of very artistic design. The cooking catalogue (Section C) shows a very interesting selection of kettles and irons. The former range in price from an article in tin supplied at a very low figure to a heavily silver-plated kettle with ebony fittings. A number of this latter pattern were supplied a short time ago for use of H.M. the King. The most popular types are a 1½ pint copper kettle of kitchen design, loaded to 400 watts to boil in 12 minutes, and a rather more ornamental brass kettle, with a cane handle, more suitable for afternoon tea use. Large quantities of these have been supplied during the past year, showing that the utility of electric appliances for both kitchen and drawing room use are appreciated. A low-priced copper shaving pot, capacity ½ pint, will boil water in three minutes. A glance through the catalogue shows a general tendency towards cheaper utensils, together with design, leaning towards the ordinary kitchen articles with which everyone is familiar. There is a useful range of saucepans of the cast-iron variety, with a thin lid, ranging from a capacity of 2 pints and a rating of 500 watts, to 12 pints rated at 1,400 watts. Potato steamers, double saucepan porringers, frying pans, &c., are shown. Irons, of course, are an important feature. Commencing with a light domestic iron for lace work, there are also several types for the heavy side of household work. The popular "249" is 4 lb. in weight. A feature in connection with irons is the automatic stand; the action of placing the iron on the stand completes the circuit, but when the iron is actually in use it is not in circuit. This has been found a good arrangement for short, intermittant work. Among the lines with which the general public are not so conversant, there are hot cupboards for linen drying in the case of large wooden constructions, or for plate or food warming in the case of the smaller iron variety. The larger type of apparatus, particularly adapted to restaurant use, is given considerable attention. First, there are large capacity water urns, ranging from 1 gallon capacity up to four, together with combined tea, water and coffee urns, and also the regulation form of *café au lait*, adapted to electricity and fitted with regulation. On the industrial side, glue pots of various descriptions, sealing-wax heaters, and other apparatus, are shown for medicinal and dental purposes. A novel innovation is the production of universal voltage apparatus. Many pages are devoted to the now well-known Silundum apparatus. Both lists are well illustrated and very neatly arranged, prices being plainly indicated.

Messrs. Eastman & Warne, Acton Vale, W.—New leaflet announcing reduced prices for their "Hot Point" electrically-heated flat-iron. Also a leaflet regarding "Hot Point" electrically-heated soldering irons.

The Premier Accumulator Co., Ltd., Cattle Market Road, Northampton.—Very finely illustrated pamphlet, showing a number of places where Premier accumulators are used, and the work they are doing. Central station service, large private installations, ship and train lighting, launch propulsion, motor-car lighting and ignition, are all represented.

Mr. Albert C. Hands, 30-32, Snow Hill, London, E.C.—A number of leaflets illustrating and giving prices of various designs and finishes of their A.C.H. luminous electric radiators.

Messrs. E. Bennis & Co., Ltd., Little Hulton, Bolton.—New pamphlet entitled "Appareils modernes pour la manutention du Charbon et des Cendres," containing an illustrated description in French of the plant supplied by the firm for the Coventry electricity works. The pamphlet, of course, is for the use of Continental engineers or works managers, and to such, copies of the pamphlet will be forwarded on application to the above address.

Mr. G. Braulik, 8, Lambeth Hill, London, E.C.—New pamphlet describing and giving prices of the "Eclipse" double carbon intense flame arc lamp, which is fitted with deposit-free globe with dioptric inner globe.

Messrs. Turners & Manville, Ltd., 5, Lloyd's Avenue, London, E.C.—Small pamphlet giving particulars of their "Leak-No" metallic compound and H.O. pipe joint cement, which they are just putting on the market.

Trade Announcements.—Messrs. Archibald Smith and Stevens, lift engineers, Janus Works, Queen's Road, Battersea, S.W.—For family reasons this firm have converted their business into a limited company, under the title of Smith, Major and Stevens, Ltd. No shares have been offered to the public, and the previous owners, Messrs. C. G. Major, E. C. Stevens and P. H. Stevens, together with Mr. P. C. Major, become directors, with Mr. C. G. Major as chairman.

Messrs. G. M. Boddy & Co., suppliers of "Metalik" lamps, are extending their London premises, having taken over the building, 15, Gray's Inn Road (lately occupied by the Electro-Motor and Dynamo Co., whose business has been taken over by Messrs. J. and H. Grevener). With the additional facilities thus afforded the firm will be able to give early deliveries for export, country and City orders.

Mr. Albert Burnstine has been appointed general agent for the Warner Engineering Co., Ltd., in the Argentine, Uruguay and Paraguay, with an office at 425, Maipu, Buenos Ayres (cable address, "Grantall," Buenos Ayres). The company has also opened an office at 2, Rector Street, New York, U.S.A. (cable address, "Interamer," New York).

Rumoured Amalgamation.—A correspondent learns from semi-official sources that meetings of shareholders in two electrical engineering companies in the Manchester district will shortly be held to consider a scheme to be put before them with a view to amalgamating the two concerns. Both have been fairly busy of late executing substantial orders.

Northampton Polytechnic, Clerkenwell. — The storage battery and automatic reversible booster balancer set required in connection with the electrical equipment of this institution, are being supplied by the D.P. Battery Co., Ltd., Bakewell.

Charge of Stealing.—At the Manchester Assizes last week, Edwin Arthur Wilson (32), salesman, was charged with stealing a large quantity of electric fittings the property of his employers, Messrs. Baxendale & Co., of Thithe Street, Manchester, and Harry Wilson (42), electrician, Wellington Road, Stockport, and Fred. Mason (45), electrician, were charged with receiving the goods well knowing them to have been stolen. Edward Kay (44), electrician, who was also charged with receiving in connection with the case, failed to surrender to his bail. E. A. Wilson was sent to prison for 12 months, Harry Wilson for nine months, and Kay and Mason for six months, each with hard labour.

Dissolutions and Liquidations. — Solium Electrical Co, Ltd.—This company resolved on October 27th to wind up voluntarily with Mr. E. Harlow, 23, King Street, Nottingham, as liquidator. A meeting of creditors will be held on November 12th.

British Eastern Electric Power Co., Ltd.—A meeting is to be held at 57½, Old Broad Street, E.C., on December 6th, to hear an account of the winding up from the liquidator, Mr. T. F. Stevens.

School Lighting.—A news correspondent writes: "Quite a score of new schools (costing from £4,000 to £12,000 each) to be built in the near future in Central and South-East Lancashire, are to be electrically lighted. Mr. R. Littler, county architect, Ribblesdale Place, Preston, is responsible for the plans of these new educational institutions."

Plymouth.—Mr. T. N. Riley, engineering master at the technical school, has requisitioned electrical machines, measuring instruments and regulating resistances, at a cost of £225.

Imports of Electrical Goods.—In answer to Mr. Clough, the President of the Board of Trade gives in the Parliamentary Papers a summary statement showing the value of each principal group of articles included in the official trade accounts under the head of articles wholly or mainly manufactured imported into the United Kingdom from foreign countries and from British Possessions respectively during 1908. It is stated that the value of electrical goods and apparatus other than machinery and telegraph and telephone wire imported from foreign countries was £1,263,265, and from British Possessions £497.

LIGHTING and POWER NOTES.

Amble.—Mr. Cecil Esmarch has submitted to the Council a report with reference to the proposed lighting of the town by electricity. The cost of the generating station is estimated at £2,368; of the distributing system, £1,794; making a total outlay of £4,162. The annual cost of upkeep is estimated at £668, including the payment of interest and capital, and the revenue, at £765 per annum; the Council decided to take a vote on the question.

Ardsley.—The U.D.C. has asked the Yorkshire Electric Power Co. if it is contemplating introducing an electric supply into the district.

Australia.—The new electricity works at Balmain (N.S.W.) of the Electric Light and Power Supply Corporation, Ltd., have just been opened by the Mayor of Balmain. The works are situated at Iron Cove, adjoining the chemical establishment of Messrs. Elliott Bros. The site is an excellent one with a water frontage of 270 ft., and is a good central position for supplying electricity to the remaining municipalities in the New South Welsh metropolitan area. The plant of the new works, contained in a substantial steel framed building, comprises two 5,000-volt, three-phase Thomson-Houston generators, direct-coupled to two Bellis & Morcom triple-expanion engines of 1,200 H.P. These are supplied with steam from two Babcock and Wilcox water-tube boilers fitted with superheaters and automatic chain-grate stokers; in addition there is a Babcock & Wilcox boiler connected with a garbage destructor, and the latter is more than sufficient to supply the steam necessary for lighting the whole of Balmain. The supply is controlled by a switchboard supplied by the Australian General Electric Co. The plant was supplied pursuant to specifications prepared by the chief engineer and general manager, Mr. J. E. Donoghue.

Belfast.—The electrical engineer has submitted a report on the additional plant required to meet the increasing demand for lighting and power purposes. The report was recommended to the Council for confirmation. Several deputations were present to ask that the centre poles be removed from the streets at certain points, and as the result of a report from the general manager, it was decided to change the centre poles to side poles in a number of streets.

Burton-on-Trent.—The L.G.B. has sanctioned the borrowing of £4,000, to be laid out as follows:—£2,900 for mains and feeders; £650 for services; and £100 for switchgear and instruments.

Birkdale.—The U.D.C. has received from the L.G.B. sanction to a loan of £370 for arc lighting and storm-proof fittings for the protection of the tantalum lamps on tramway poles at Ainsdale.

Camberley.—The U.D.C. has decided to apply for electrical powers. It will be remembered that the Yorktown and Blackwater Gas Co. obtained electrical powers for this district some little time ago, but a provision was made that the powers should not be exercised for 12 months, in order that the Council might take the matter up if it thought it wise to do so. Hence the recent decision of that authority.

Chippenham.—The T.C. has decided to inform the B. of T. that it is unable at present to carry out the electricity order.

Clevedon.—A prov. order for electric lighting is to be applied for by Messrs. Christie. The scheme is to be on the overhead system. Mr. Christie has informed the Council that with 250 50-C.P. lamps the cost per lamp per annum would be 37s. 3d. for 1,750 lighting hours.

Continental Notes. — Italy. — La Société Anglo-Romano, which has already a large electricity generating station at Subiaco, has just started work on the establishment of a new one at Arci, 4 km. from Tivoli. Water-power is being utilised, the plant to be installed comprising two sets of 4,500-H.P. turbines and 30,000-volt alternators, which are being built by Messrs. Ganz and Co., of Budapest.

Alsace.—The municipal authorities of Mulhouse have decided on the extension of their electric lighting undertaking at an estimated cost of £100,000.

Darlington.—By ten votes to nine, the T.C. has decided to support Maidstone T.C. in promoting a Bill consisting of the wiring clauses struck out of the E.L. Acts Amendment Bill, empowering local authorities to deal in lamps, motors, and other fittings.

Dawlish.—With reference to the proposed electric light installation, Mr. Parves, consulting engineer, recently wrote to the Council that he was pleased to know that, subject to the steel poles being approved both as to design, position, and height of wires, the Council was prepared to give permission for the erection of overhead mains in the whole of the streets of the town. In the case of a town like Dawlish it was a *sine qua non* that overhead mains should be used. The Clerk read a petition received from ratepayers who begged the Council not to permit the use of overhead wires, which, in their opinion, would be detrimental to the appearance of the district, and would depreciate the value of the property. The Council, having come to a decision in the matter, allowed the communication to lie on the table. Mr. W. Leaman gave notice of motion to rescind the resolution on the books raising no objection to overhead mains for the electric light.

Dundalk.—The U.D.C. is arranging for a loan of £20,000 wherewith to carry out the proposed electric lighting and power scheme for that town. The loan is to be repayable by a sinking fund within twenty-five years.

Eastleigh and Bishopstoke.—The B. of T. has asked the U.D.C. if it can give an assurance that there is a probability of the Council being able to put the E.L. order into operation within another year, if the order be extended for that period. The Council has referred the matter to a committee.

Grays.—The U.D.C. has applied to the L.G.B. for a loan of £900 for electricity purposes.

Hants.—£846 is to be laid out for additional electric plant and a calorifier at Fareham Asylum, the total mentioned being made up as follows: 90-H.P. engine, estimated cost £376; 300-ampere dynamo, £270; calorifier, £200.

Hastings.—The Corporation is seeking new powers by promoting a new local Act, the terms of which were discussed at the last meeting of the Council. Clauses to enable the Corporation to do electrical work were strongly contested by the opponents of municipal trading. On the other hand, it was urged that in the interest of the Corporation electrical undertaking it was essential that it should have power to supply fittings, as at present people would not take the electric light in consequence of the cost of fittings. The general idea was that the Corporation should be in a position to do wiring and fitting up, and that it should be repaid by instalments. Eventually the clauses were passed to be included in the Bill.

Hertford.—At the meeting of the Metropolitan Water Board on November 5th, it was agreed that £1,410 be laid out in reconstructing the Hertford sewage works. The Works and Stores Committee were authorised to contract for the supply of electrical energy to the works.

Kingswinford.—At a meeting of the R.D.C. on Monday, the chairman stated that the arbitration between the Midland Electric Corporation and the Council with reference to the lighting of the district took place on the previous Tuesday. The result was not yet known, but he thought the Council would be satisfied with it.

Lamorbey (Kent).—The Bexley U.D.C. has sealed an agreement with the Foot's Cray Electricity Supply Co. for the provision of electricity for Lamorbey.

Berkhampsted.—The Council has sealed an agreement with the Chesham and District Electric Light and Power Co. for powers in the district.

Llandaff and Dinas Powis.—The R.D.C. has received from the L.G.B. sanction to a loan of £2,960 to cover the cost of the Whitchurch electric lighting scheme, under which energy will be taken from the South Wales Power Co.

Middleton.—The T.C. has applied to the L.G.B. for a loan of £3,000 for cables for five years.

Rhyl.—An inquiry was held by Mr. H. R. Hooper, of the L.G.B., on November 3rd in respect to the U.D.C.'s application for sanction to borrow £5,000 for the purposes of the electric light works. Evidence was given by the electrical engineer, Mr. Wright, to the effect that since he had had charge of the works, there had been considerable trouble with the mains. These were now righted, but it was felt that the plant was not up-to-date, and was too large for the town's needs. What was required was a smaller plant of an up-to-date pattern. The cost of the works was originally £27,000, but that included provision for a tramway which was never made. They would save at least £350 per annum on the works cost alone by putting in a smaller plant. The Inspector said he realised that Rhyl had been hard hit by the undertaking, but he urged that the proper course to adopt was not so much to reduce the works cost, but to develop and secure fresh customers. He suggested that the Council should borrow money for mains extension, and by careful development bring the works to making a profit.

Royton.—Messrs. Baker & Sons, Parliamentary agents to the U.D.C., have communicated with the Council respecting the application of Oldham T.C. for permission to supply electricity in the district. They suggest that Oldham will only supply consumers who are prepared to take a quantity of electricity which will be remunerative, and that small consumers will be unable to obtain a supply because it might not be worth while for Oldham to give it. If all the remunerative customers obtained their supply from Oldham, it would not be worth while for Royton to obtain a prov. order to supply the rest. They advise the Council to obtain a prov. order, and then negotiate with Oldham for a supply of current in bulk or for the transfer of the order. The Council has appointed a sub-committee to go into the matter.

Runcorn.—The U.D.C. has decided to consent to the applications of the Castner-Kellner Alkali Co., Ltd., and Messrs. G. H. Cox and H. J. Falk, of Liverpool, for prov. orders for electric light.

St. Helens.—The Education Committee has decided to have the new Higher Grade School lit by electricity, and has asked the Electricity Committee to reduce the price of energy for education purposes from 4½d. to 3½d. per unit.

Wednesbury.—The T.C. has applied for a loan of £345 for meters and mains already provided; £1,750 for small mains, extension services and meters, for two years; and £2,000 for other main extension services and meters.

Whitchurch.—The L.G.B. has sanctioned a loan of £2,960 for the electric lighting scheme. The number of lights required to make the scheme a success was 930, and in 1907 the Llandaff District Council had 800 promises, and it is thought that there will be not the slightest doubt that the number will be made up. The electric light will be supplied by the South Wales Power Co. A similar scheme at Radyr, also within the jurisdiction of the Llandaff Council, has proved profitable, and the Whitchurch scheme will be undertaken immediately.

Whitehaven.—The Harbour Commissioners have decided to defer for a year the putting down of the proposed plant for lighting the Harbour by gas, and to continue taking electrical energy from the T.C., who will before the end of a year quote special terms for the supply. The T.C. will supply current for the next year at a minimum of £250 for the first 28,500 units, and 3d. per unit beyond.

Wingate (Co. Durham).—The parochial electors have decided to ascertain the terms of the Electric Power Co. for lighting the parish. The estimated cost of the installation is £165, and the annual cost £70.

Wolverhampton.—The report on the Council's electrical undertaking for the year ending June 30th last, shows that 1,244,612 units were sold for lighting; 4,135,169 for power; 1,471,632 for tramways, making a total of 6,851,413 units sold. The increase in power supply amounted to 2,026,697 units, but there was some falling off in the lighting and traction supply. Application has been made to the L.G.B. for sanction to the borrowing of £10,000 for mains extensions.

TRAMWAY and RAILWAY NOTES.

Blackburn.—Interesting figures are contained in the half-yearly tramway report, issued on Saturday by the Corporation. It appears that the traffic expenses were £7,358; general expenses, £1,618; general repairs and maintenance, £4,098; and cost of current, £5,862. The total expenditure was £18,938, the income was £32,697, leaving a balance of £13,759 to be carried to the net revenue account. The total income of this account was £13,788, and the expenditure for repayment of loans, sinking fund, interest, &c., £10,832, showing a net surplus of £2,955 on the half-year's working.

Continental Notes.—AUSTRIA.—The municipal authorities of Iglau have secured a concession for a projected electric tramway between the town and the railway station.

SWITZERLAND.—An 80 years' concession for the construction and working of a narrow-gauge electric railway from Stalden to Saas-Grund has been granted. The line, which is to be a single track of metre gauge, must be completed within three years from the commencement of work.

A decree has been granted to Mr. Alfred Hurter, of Oerlikon, on behalf of a company to be formed with head office at Saas-Fée, for an 80 years' concession for the construction and working of a funicular electric railway from Saas-Grund to Saas-Fée. The line is to be a single track of metre gauge.—*Board of Trade Journal.*

SWEDEN-DENMARK.—A Swedish engineer has drawn up a project for the construction of an electric railway from Malmo to Copenhagen, passing under the Sound. The line would be about 147 miles long, with about 10 miles of tunnel. The project has been submitted to a Special Commission appointed by the Swedish Government.—*Board of Trade Journal.*

ITALY.—A comprehensive scheme of electric railway works has recently been decided upon by the adoption by the Parliament of two Bills which project the conversion of certain existing railways to electric traction and the construction of new electric railways. The former class comprises four different groups of lines, the first representing an extension of the present system of electric railways around Milan. It is proposed to reconstruct in connection with the existing line between Milan and Gallarate, the lines leading from the latter to Laveno and from Gallarate to Arona; a similar conversion is contemplated for the line Milan-Lecco leading to the Como Lake, and for that from the Usmate station to Bergamo. The second group is that of the frontier tunnel, and comprises an extension of electrical working in the Simplon Tunnel from Iselle to Domodossola; and the favourable experience gained in the former case has also led to the decision to electrically equip the Bardonecchia-Modane section of the Mont Cenis Railway. In the case of the third group, which embodies the tunnels on the southern declivity of the Apennines to Genoa, the "galleries" near Genoa and to Sampierdarena will first be converted, then the Giovi Tunnel, and, finally, the San Guiseppe-Savona section on the direct line between Turin and Savona. The fourth group refers to the section between Naples, Pompeii and Salerno, and the branch from Torre-Annunziata to Castellamare di Stabia. Among the new railways projected the first position is occupied by two new lines over the Apennines, which would materially accelerate traffic with Rome by reducing the time of the journey by three hours. An entirely new route is proposed for the railway between Bologna and Florence, whilst the line from Sant Arcangelo di Romagna to Urbino is of special importance to tourists. The other new electric railways include the long-discussed direct line between Rome and Naples, which is at last to be realised.

Dudley.—The Tramway Co. having applied to the B. of T. to appoint an arbitrator to fix the price to be paid for energy from June 30th last, the Council is to inform the Board that it concurs in the application.

Hendon.—The Council is to visit the depôt of the Metropolitan Electric Tramways, Ltd., in response to an invitation sent by Mr. A. L. Barber. The visit is in connection with the proposal to run a service from Golder's Green tube terminus to Hendon, which would require the approval of the Council as road authority.

Ilford.—The Council has decided to separate the tramways from the electricity undertaking. A tramways manager is to be appointed to deal with the tramways alone. Mr. Woolstencroft, who for some years has been the tramways superintendent, has been given the management *pro. tem.*

Kingswinford.—The R.D.C., in consequence of the attitude of the tramway company on the question of children's fares, is urging the Staffs. Education Committee to convey students to the Dudley Schools in a special vehicle, instead of on the company's cars as at present.

London.—In June last the Metropolitan Asylums Board entered into a contract with the Tudor Accumulator Co. for the maintenance of the battery supplied by them to the Children's Infirmary for a 5-cwt. electric motor vehicle. The agreement provided for a fixed payment at the rate of £10 per year for any number of vehicles up to six, plus ½d. per mile for 5 cwt. vans. Since the agreement was entered into a 25-cwt. van for heavy goods has been purchased, and the company offer to maintain the battery of this car at a rate of 1½d. per mile run. The engineer-in-chief having certified that this amount is reasonable the agreement is to be entered into.

L.C.C.—The Highways Committee is recommending that the Woolwich-Eltham tramways should be constructed, using a double (positive and negative) trolley wire construction in order to get

over the objections of the Greenwich Observatory authorities. The cost will be £76,000, and it is expected that there will be a loss in working for some years to come.

City.—The Bridge House Estates Committee recommended again to the City Council, last week, the construction of a new bridge, 80 ft. wide, over the Thames, having its outlet on the north at the eastern end of St. Paul's Cathedral, also the reconstruction of Southwark Bridge. The St. Paul's Bridge would carry a double line of tramways, which would pass underground at Knightrider Street and rise to the surface near Goswell Road, thus giving another link between the North and South London tramways of the L.C.C.

New Zealand.—The annual report of the Wellington Corporation Tramways and Lighting Department, of which Mr. Stuart Richardson is engineer and manager, shows that as regards the tramways, 21,679,902 passengers were carried, resulting in a traffic revenue of £129,032; street lighting and sundry consumers of energy for lighting and power added £7,247, and with minor items the total revenue amounted to £136,436. The traffic revenue on the city lines amounted to 14·12d. per car-mile, and the expenses on the whole system to 9·69d. (including power supply). Interest absorbed £20,652, sinking fund £4,934, and depreciation £13,243; the net balance being £5,934. A 750 Belliss-E.C.C. generating set is being added to the power station, bringing its capacity up to 3,000 kw., supplied by nine Lancashire boilers. During the year 590 h.p. of private consumers' plant has been added, making a total of 1,335 h.p. connected. Some 5,173,971 units were delivered from the power station at a cost of ·749d. per unit, or inclusive of depreciation (·165d.), interest and sinking fund, 1·15d. per unit; as compared with 1·09d. in the previous year. The electric lighting department sold 2,004,304 units during the year to 4,136 consumers (including 3,821 lighting, 244 power and 71 heating). The total revenue amounted to £44,321, and after meeting financial charges and depreciation (£5,466) there remained a surplus of £4,272. Owing to the indifferent character of the plant at this station, the working expenses per unit sold amounted to 2·99d., and the overall cost (including ·65d. per unit depreciation) to 4·79d. per unit. A 1,500-kw. Parsons turbine set is being added to the station, which is being extended and brought up to date so as to increase the efficiency.

Newcastle-on-Tyne.—Sir J. Baxter Ellis, in a letter to the Tramway Committee announcing his resignation of the chairmanship, remarked that the new system of working was a failure, and that it would be better to go back to the position of 18 months ago, subject to minor alterations.

Northampton.—The Tramways Committee has recommended the T.C. to apply for powers for the construction of tramways from All Saints' Church to Far Cotton. The estimated cost is over £13,000.

South Lancashire.—The South Lancs. Tramways Co. has intimated to the Little Hulton, Farnworth and Worsley Councils that it has abandoned the idea of constructing tramways in those districts for the present.

United States.—The New York, New Haven and Hartford Railway is, according to *Electric Traction Weekly*, obtaining a number of new motor-cars for its suburban service, which will be equipped to operate on both the 11,000-volt a.c. trolley and on the 600-volt d.c. third-rail system, the latter being necessary to enable the cars to run over the New York Central's lines. The cars are intended to draw two 50-ton trailers and to accelerate at a rate of ·7 mile per hour per second. The cars are equipped with four series compensated motors, each of 200 h.p.; these and the step-down autotransformers are supplied with forced ventilation. The Pittsburg Railways Co. is installing three 5,000-kw. Westinghouse steam turbines and 11,800 h.p. of Babcock boilers, as an extension to its present 9,000 kw. plant at Brunot Island.

The Washington, Baltimore and Annapolis Railway has practically finished the work of changing over its system of working from single-phase a.c. to d.c. It is estimated that the change will lead to an annual saving of $100,000; one reason for changing was that the single-phase system prevented the company from extending its business in Washington.

The attitude of the Illinois Central Railway in shelving the electrification of its terminal lines in Chicago, is the subject of much adverse comment. The president of the company in considering the matter, estimated a loss of $600,000 yearly by conversion, but it is noted that he made no allowance for probable increase in receipts after electrification.

The New York Edison Co. has made a formal offer to supply power for the proposed new Broadway-Lexington Avenue subway, and other lines in connection therewith. The company considers that it is in an exceptional position to supply energy on advantageous terms.

Wolverhampton.—In the annual report of the Corporation Tramways Committee, the following statement is given of traffic receipts, &c., for the first six months of this financial year, ending September 30th last, as compared with the same period last year:—

Passengers.	Receipts.	R.P.C.M.
4,647,667	£21,725	10·553d.
4,814,268	£22,533	10·901d.

The reduction in the receipts is again due to the continuation of trade depression in the district generally.

TELEGRAPH and TELEPHONE NOTES.

Trunk Telephone Calls.—In reply to a question whether the duration of a trunk telephone call could be extended from three minutes to five minutes, Mr. Sydney Buxton replied that experience in nearly all countries had shown that a period of three minutes was the most convenient unit. A unit of five minutes would involve a higher charge and would reduce the useful traffic capacity of costly lines.

Italy.—The Government will shortly ask for powers to spend a million sterling on the construction of a number of telephone lines.—*Board of Trade Journal.*

Cables.—Falmouth-Bilbao repaired November 6th; La Reunion-Mauritius interrupted November 3rd; Cayenne-Salinas interrupted November 3rd.

Switzerland.—The *Journal Telegraphique* states that the telegraphic receipts of Switzerland during 1907 were 12,988,888 fr. and the expenses 12,467,453 fr. leaving a profit of 521,435 fr. The number of messages handled was 4,917,018 as against 4,918,679 in 1906. There were 2,318,960 international telegrams while 1,008,080 passed in transit. The system consisted of 5,803 km. of line and 23,327 of wire, of which 2,453 km. are underground. The telephone service consisted of 17 574 km. of line and 291,214 of wire while the subscribers totalled 291,214. The number of offices was 3,031, of which 726 were telephone stations; 4,385 employés were engaged in the joint services in 1907.

Bolivia.—The Bolivian telegraphic system in 1907-8 consisted of 5,107 km. of line and 6,087 of wire. There were 120 offices, and 590,143 telegrams were handled. The receipts of the Government system amounted to 365,373 fr. and the expenses to 789,638 fr. The value of telegraphic business done by all enterprises, Government and private was 804,237 fr.

Wireless Telegraphy.—From the *St. James' Gazette* of October 28th we learn that Signor Marconi returned from America by the *Caronia*, and at an interview declared that the Cape Breton station would not be finished until January 1st, when operations would be commenced. He did not think the working would affect the cable companies *for some time.*

CONTRACTS OPEN and CLOSED.

OPEN.

Accrington.—A proposal is being considered to acquire a motor tower wagon for use by the Accrington Electricity and Tramways department.

Australia.—Victoria.—Electric lamps for the P.M.G. See "Official Notices" October 15th.

Melbourne.—February 22nd, 1910. The Postmaster-General is calling for tenders for the erection of wireless telegraph stations on North and South Heads, Sydney, and on Fremantle Heights, Western Australia, capable of communicating with ships up to 1,000 miles.

Melbourne.—Telegraph and telephone material, for the P.M.G. See "Official Notices" October 29th.

Melbourne.—November 29th. 1,250 opalescent arc lamp globes for the Council. See "Official Notices" to-day.

Belgium.—December 31st. The municipal authorities of Jupille are inviting tenders for the concession for the lighting of the little town by gas or electricity.

Birmingham.—November 20th. The Guardians invite tenders for the maintenance of their private telephone installation at the Workhouse, Dudley Road, for 12 months. Apply to Master of the Workhouse.

Bradford.—November 13th. General stores for the Tramways Department for a year (returnable deposit £1 1s.). Tramway offices, 7, Hall Ings, Bradford.

Chatham.—November 25th. Incandescent electric lamps, &c., for a year; Chas. Day, Borough Surveyor.

Canada.—Montreal.—Tenders are being called by the Saraguay Electric and Water Co. for turbo-generators of 2,000 kw. capacity. Proportionate increase of power-house boilers and other equipment will be made likewise. Charles Brandeis, consulting engineer, 4, Phillips Place.

Ottawa.—November 25th. Tenders are invited for the packing of material and supplies for points along the Yukon telegraph line between Quesnelle and Atlin, in the course of the season of 1910, 1911 and 1912. See this column for October 29th.

Nelson.—The street railway by-law was carried almost unanimously. The company's plans as to initial equipment and extension comprise:—Motor-generator set, including sheds, switchboard, and necessary cable from sub-station to trolley lines, $11,000; two double-truck four-motor cars and two trailers, $12,000; car barns, machine shop, and full line of repair parts, $2,500; rotary broom, and apparatus necessary to attach same, $1,200; belt-line extension, $16,000; total, $43,700.—*The Canadian Engineer.*

Dublin.—November 29th. General stores for the Dublin United Tramways Co. (1896), Ltd. See "Official Notices" November 5th.

December 1st.—Electric wiring and fitting of the Workhouse buildings, nursing sisters' residence, and North City Dispensaries, for the North Dublin Board of Guardians. Specifications at the office, North Brunswick Street, or from the consulting engineer, Mr. L. J. Lawless, 27, Castlewood Avenue, Rathmines, on payment of the cost of production.

Edinburgh.—The T.C. invites tenders for electrical installation at McLeod Street Police Station. Frank A. Newington, engineer, Electricity Station, Dewar Place.

Edmonton.—November 23rd. Electric light and power installation at the new infirmary. See "Official Notices" November 5th.

Farnworth.—The D.C. is in the market for 50-C.P. lamps for tramway pillars in place of incandescent lamps.

Germany.—The municipal authorities of Bietburg, Westphalia, are about to invite tenders for the establishment of a central electric lighting station in the town.

Hull.—November 17th. Unwashed slack for the electricity works for six and twelve months respectively. Mr. H. Bell, city electrical engineer.

India.—Lucknow.—December 31st. The Municipal Board invites proposals for supply of electrical energy, coal or oil gas. See this column for October 29th.

London.—L.C.C.—Covering with asbestos tape about 2¾ miles of lead-covered high and low-tension electric cables in manholes. See "Official Notices" November 5th.

Manchester.—November 19th. The Electricity Committee invites tenders for the work required in connection with the provision and laying of a 10-in. diameter rising main from the pumping station at Clayton Vale to the Stuart Street generating station. Forms, &c., from the Secretary, Electricity Department (two guineas deposit).

Wakefield.—November 25th. Stores for the Wakefield and District Light Railway Co. See "Official Notices" to-day.

Warrington.—November 19th. Telegraph materials for a year, for the Cheshire Lines Committee. S. Saxon Barton, Stores Superintendent, Cheshire Lines, Warrington.

York.—November 25th. E.L. fittings, lamps, &c., for the North-Eastern Railway Co.; F. H. Clark, Stores Superintendent, Gateshead.

Telegraph stores, for the North-Eastern Railway Co.; C. H. Ellison, Telegraph Superintendent, York.

CLOSED.

Cape Town.—The following tenders were received by the Corporation for the supply of wrought-iron arc lamp carriers required in connection with the Green Point and Sea Point electric lighting:—

Clyde Engineering Works		£99 17
Hudson & Hopkins	(accepted)	110 0
J. F. Nosworthy & Co.		118 0
Walter Donald		119 0

India.—It is now reported that the A.E.G.-Union Electrique, of Brussels, which is a subsidiary of the Berlin A.E.G., has received from the Tata Iron and Steel Works Co. an order for motors, turbines and lighting equipment.

Kilkenny Asylum.—Messrs. Mcguire & Gatchell, Ltd., of Dublin, to whom has been entrusted the electrical installation of this Asylum, have placed the order for the necessary storage battery of 120 cells with the D.P. Battery Co., Ltd., of Bakewell.

London.—The Metropolitan Asylums Board has placed orders as follows:—

J. W. Gray & Sons, re-establishing telephonic connection between Gore House and the Hospital, £56 10s.

W. J. Fryer & Co., two electric motors, with cables, switches, &c., £129 18s.

L.C.C.—The Highways Committee received the following tenders for two marine-type boilers, complete with coal elevator, machine stokers, induced draught and air-heating apparatus, required for the first extension of the tramways central car-repair depôt:—

	Stokers A type.	Stokers B type.	Stokers C type.	Stokers D type.
Davy Bros., Ltd. .. .. (accepted)	£2,858	£2,918	£2,923	£2,818
James Howden & Co., Ltd.	3,045	3,091	3,058	—
Samuel Hodge & Sons, Ltd.	3,154	3,191	3,234	—
Ditto (alternative) ..	3,524	3,561	3,594	—
H. & T. Danks (Netherton), Ltd. ..	3,190	3,250	3,190	—
John Fraser & Son	3,206	3,306	3,286	3,186
Westminster Ventilating Co. ..	—	3,349	3,323	—
Lindsay, Burnet & Co.	3,342	3,385	3,354	—
Clayton, Son & Co., Ltd.	3,444	3,494	3,509	3,424
Edwin Danks & Co. (Oldbury), Ltd.	3,637	3,729	3,702	—
Richardsons, Westgarth & Co., Ltd.	4,482	4,587	4,737	—

Estimate of chief officer, £2,500.

Messrs. W. T. Henley's Telegraph Works Co. are to carry out certain work in connection with the underground telephone system now in use between the various sections of the Tramways Department, at about £2,200, as an extension of an existing contract.

Portsmouth.—The Tramways Committee has accepted the tender of Messrs. Steel, Peach & Tozer, Ltd., for 200 steel tramway tires, at £1 10s. 3d. per tire.

Sheffield.—The T.C. has accepted the tender of the British Insulated and Helsby Cables for two miles figure-8 copper trolley wire, at 7⅞d. per lb. less 2½ per cent.

Spain.—Messrs. Drake & Gorham, Ltd., have received an order for 50 of their new registered pattern shuntless single-enclosure lamps for the Spanish Arsenal.

Russia.—The Compagnie Union-Electrique A.E.G., of Brussels, has secured a contract for three sets of 2,500-H.P. steam turbines and alternators for the power station in connection with the electric tramway system in Odessa, as well as 100 cars, with motor equipment for the same lines.

FORTHCOMING EVENTS.

Institution of Electrical Engineers (Birmingham Section).—Friday, November 12th. At 7 for 7.15 p.m. At the Grand Hotel, Birmingham. Annual dinner.

Physical Society of London.—Friday, November 12th (to-day). At 8 p.m. At the Imperial College of Science, South Kensington, S.W. Meeting. Paper on "Some Further Notes on the Physiological Principles underlying the Flicker Photometer," by Mr. J. S. Dow; and other papers.

The annual exhibition will be held on Tuesday, December 14th, from 3 to 6 and from 7 to 10 p.m.

Northampton Institute Engineering Society.—Friday, November 12th. At 5.45 p.m. Paper on "The Application of the Steam Turbine to Marine Propulsion," by Mr. C. B. Dicksee.

Birmingham and District Electric Club.—Saturday, November 13th. At 7 p.m. At the Colonnade Hotel, Birmingham. Paper on "A Discourse on Power Generation and the Transmission and Distribution of Electrical Energy," by Mr. C. de Hoedt.

Glasgow Technical College Scientific Society.—Saturday, November 13th. At 7.30 p.m. Paper on "Modern Condensing Installations," by Mr. W. A. Dexter.

Electro-Harmonic Society.—Monday, November 15th. At 8 p.m. At the Holborn Restaurant. Concert. Ladies' night.

Institution of Electrical Engineers (Glasgow Section).—Tuesday, November 16th. At 8 p.m. At 207, Bath Street, Glasgow. Inaugural address by Mr. E. G. Tidd.

Junior Institution of Engineers.—Tuesday, November 16th. At 8 p.m. At the Royal United Service Institution, Whitehall. Presidential address, on "Recent Warship Machinery," by Engineer Vice-Admiral H. J. Oram.

Institution of Civil Engineers.—Tuesday, November 16th. Discussion on three papers on "Electric Railways."

Institution of Electrical Engineers (Manchester Section).—Tuesday, November 16th. At 7.30 p.m. At the University, Manchester. Paper on "Telephones," by Mr. L. E. Wilson.

Institution of Electrical Engineers (Students' Section).—Wednesday, November 17th. Meeting at 7.45 p.m. at 92, Victoria Street, S.W. Opening address by Mr. J. H. Rider on "The Importance of Attention to Details."

Institution of Electrical Engineers (Leeds Section).—Wednesday, November 17th. At 7.15 p.m. At the University, Sheffield. Paper on "Some Experiments on Single and Stranded Fuses," by Mr. W. T. MacCall.

Illuminating Engineering Society.—Thursday, November 18th. At 8 p.m. At the Royal Society of Arts, 18, John Street, Adelphi, W. Opening meeting. Inaugural address by Prof. Silvanus P. Thompson, D.Sc., F.R.S., first President.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

The following orders are issued for next week:—

Commanding Officer—Col. R. E. B. Crompton, C.B.

Monday, November 15th.—"A" Company. Technical drill, 7 to 9.30 p.m.

Tuesday, November 16th.—"B" Company. Technical drill, 7 to 9.30 p.m.

Wednesday, November 17th.—Gymnasium, 6.30 to 9.30 p.m.

Thursday, November 18th.—"C" Company. Technical drill, 7 to 9.30 p.m.

Friday, November 19th.—"D" Company. Technical drill, 6.30 to 7.30 p.m. Company supper at "The Feathers," at 8 p.m. Names must be given in as soon as possible, as accommodation is limited.

Saturday, November 20th.—"B" Company. Week-end run at Coalhouse Fort. Parade at Fenchurch Street Station at 3 p.m. Tickets will be issued at the station.

(Signed) P. H. Campbell, Capt. R.E. and Adjutant,
For O.C. E.E., L.D.

NOTES.

School Lighting Rates in America.—An important ruling in favour of the Edison Electric Illuminating Co., of Boston, has just been handed down by the Board of Gas and Electric Light Commissioners, of Massachusetts, in relation to a request for reduced electrical rates for school houses by the Boston School Committee. The Commission holds that no grounds exist on which to order a reduction in rates, as compared with the charges applied to other customers, and that the fact that the customer is a municipality in nowise justifies such discrimination. The School Committee claimed that the City of Boston ought to be entitled to a lower rate than other customers; that it costs the central station company less to serve the city, in proportion to its other business; that the schools are large takers of electricity, and that the demand upon the station does not come at the time of the peak load. The Commissioners find that they are asked by the Committee to discriminate in favour of the schools over all other customers of the company, and that such discrimination is in nowise justified by the conditions. It cannot be seriously urged that there is any material difference between the cost of serving the schools, and the cost of supplying other customers. The board says that the two items of advertising and collection would be a fraction of a farthing per kilowatt-hour, as saved in serving the schools, and would, therefore, be insignificant in their influence upon the cost of production and distribution. It maintains that other customers are fully as desirable as the schools, on the ground of the hours in which they use electricity, and that no discrimination can fairly be applied here. It has long been the established policy of the Massachusetts Gas and Electric Light Commission to discountenance discrimination based solely upon the amount of electricity consumed by different customers. The schools consume a large amount of energy in the aggregate, but the consumption of each building is relatively small. The buildings are also scattered over many square miles of territory, and cannot usually be supplied in group, to resulting economy of investment and operation. A private owner of similarly located buildings would not be entitled to a reduction simply because his total electricity consumption was large in the aggregate. Finally, the Commissioners point out that the right granted by a city or town to a company to erect wires over or under the public streets, is not a permission given for the private benefit of the company, but for the general public welfare. Hence any attempt to charge for the use of the streets, either directly in the form of a tax, or indirectly in the form of reduced rates, becomes virtually an effort to shift the burden of taxation in part from the shoulders of the taxpayer to the consumer of electricity, as such. The Commission, therefore, has refused to order any special rates for the schools, stating, in conclusion, that if any consumer, including the municipality, considers that the rates are in themselves excessive, the Commission has ample authority under an appeal to make any such modifications as it may deem necessary.

Boiler Explosions in Great Britain and America.—During the year ending June 30th, 1908, in the United Kingdom 35 boiler explosions proper occurred, out of a total of more than 150,000 boilers in operation, causing an aggregate of 14 deaths and 23 injuries. While it is not possible even approximately to estimate the number of stationary and portable boilers in use in the United States, it is known that during the same period there were some 470 explosions, with a death roll of 281, or about 14 times as many explosions and 12 times as many deaths on land alone as on land and water in Great Britain. In the United States there is no Federal law governing the operation and inspection of land boilers, either stationary or portable, and only five States have such laws, and not all of these furnish adequate protection to steam users; and in the majority of large cities there are not proper regulations pertaining to the installation, inspection and operation of steam boilers. While, in Great Britain, the laws are few and simple, they are enforced.—*Power.*

The Man who Didn't.—A gentleman who recently had an electric installation put down engaged a handyman to take charge of it. The plant was only a small one, requiring but a few hours' running every other day to charge the batteries. It was suggested, therefore, that the new man could fill in his ample spare time with sundry other work.

Strong opposition: "The plant required the whole of his time!" And sure enough every day, from dawn to dewy eve, the engine was to be heard thumping merrily away, running up the oil bill, with the "engineer" in close attendance. His employer perforce had to engage an extra man for the other work.

By and by somebody advised him that there must be something wrong for so small a plant to need so much running. He wrote indignantly to the contractors, and in due course their representative came down from London. The engine and its attendant were busy with their eight-hours' day when he walked unexpectedly into the engine room. A glance at the switchboard; an astonished look at the plant, and his eagle eye noted the interesting fact that the dynamo was running with the brushes held off; busy, like the man, doing nothing.

The ingenuous handyman now helps to swell the unemployment problem.

Northampton Polytechnic Institute.—The annual prize distribution will be performed on December 10th, by Sir J. Wolfe Barry.

The Light that Failed.—

The other day we got a wire
From Ponsonby de Jones, Esquire.
Said he: "Plant's broken down,
And Brown, C.E., from town
Came down, and damned the lot
As rot, upon the spot.
Send down your man to-day,
I pray, to take away
The whole. As for your bill,
I will pay simply—*nil*."

In view of his excited tones,
We thought we'd wire to Mr. Jones.
We said: "There must be some
Misunderstanding; one
We'll easily put right,
At sight. We'll send to-night
Our foreman, Simpson, who
Will do the trick for you."
We got a note within a day
From Simpson, care of P. de J.

He wrote: "I found down here when I arrived,
A frantic crowd of sense and light deprived.
First, Mr. Brown, consulting engineer,
With two assistants and their testing gear;
The butler, chauffeur, gardener, and bands
Of servants, labourers and stablehands;
And villagers and tenants of th' estate;
All questioning the engineman and mate;
While Mr. Ponsonby de Jones, and kin,
Were there to lead the chorus of the din.
I showed myself, and with this mob around,
I took a casual walk about and found
An interesting circumstance which seemed
To me to simplify the case. I beamed
Upon the crowd, and said, 'Now mark me right!
I put this main-switch on, and lo—the light!'"

Moral.

If anything's wrong,
Heed not detractors;
Shun language that's strong,
And trust your contractors.

H. R. T.

Electro-Harmonic Society.—The next concert (ladies' night) will be held in the King's Hall, Holborn Restaurant, on Monday evening, November 15th, at 8 o'clock. The artistes on this occasion will be:—Mr. Robert Radford; The Alexandra Ladies' Quartette: Miss Nellie Dunford, Miss Beatrice Ferguson, Miss Lilian Berger, and Miss Mary Proctor; Miss Gwendolen Mason (harp soli); Master Lloyd Shakespeare (cornet soli); Mr. Stuart Debnam (humorous interludes); and Mr. Harrison Hill (humorous sketches). We are requested to draw special attention to the fact this concert is to take place on *Monday* evening, instead of the Society's usual Friday evening.

British Tungsten Filaments for America.—Mr. F. Harrison, manager of the International Filament Co., Ltd., London, together with Mr. W. Stewart, financially interested in the enterprise, have been in the United States for some time making contracts for the disposal of tungsten lamp filaments, which are manufactured in England by a secret process controlled by Mr. Harrison, and are sold throughout Great Britain and on the Continent by the Bryant Trading Syndicate, of London. These gentlemen report that they have been quite successful in placing their filaments in the States, both with the independent manufacturers and with some members of the incandescent lamp combination. The same company also makes parts of lamps and has a patented sealed package for transporting tungsten lamps, so arranged that the lamp can be tested before the seal is broken, thus limiting claims to actual breakages in transit. Messrs. Harrison and Stewart have incorporated under the laws of New York a company, named the Electrical Manufacturers' Agency, for handling their goods in the United States, which will have headquarters in New York. They also declare that if the market for their filaments turns out as satisfactory as it now promises, a factory will be established in that country in order to get the benefit of the 45 per cent. tariff tax.—*Electrical World.*

Sealed Tungsten Lamp Cartons.—A sealed tungsten lamp carton, says the *Electrical World*, is being adopted by many manufacturers abroad, in order to minimise claims made for lamps broken in transit. The lamp may be examined and tested, and even lighted while in the carton. It cannot be removed without breaking the seal, and, therefore, enables a hard and fast line to be laid down as between the seller and the buyer as to claims for breakage in transit. In case a broken lamp is returned to the sender within a reasonable period, with the seal of the carton unbroken, it is fair to assume that the breakage occurred in transit and a claim is therefore allowed. The cartons, which are of square cross-section, and thus not likely to roll off the counter or shelf, have a label including brief instructions as to test and conditions of claims. Other advantages for the cartons are that they do not need any packing when cased; the breakage in transit is considerably reduced; improper claims for breakage are prevented, and arguments between the buyer and seller are minimised.

Parliamentary.—In the House of Commons on 4th inst. the Lords' amendments to the Commons' amendments to Electric Lighting Acts (Amendment) Bill were agreed to.

Minerals of Great Britain and Ireland.—Reporting to the Home Office on the production of minerals in the United Kingdom and Ireland during 1908, Mr. R. A. S. Redmayne states that the bulk of the compounds of barium are supplied by Durham, Northumberland and Shropshire. Northumberland supplies the valuable mineral witherite, or carbonate of barium, and the produce of Durham and Shropshire is mainly heavy spar, or sulphate of barium. During the year 38,947 tons were raised, of the value of £35,221. Bauxite, sometimes called alum clay, occurs in the form of seams lying between sheets of tertiary basalt in County Antrim. The production of alumina from bauxite and the extraction of the metal in the electric furnace was started in the United Kingdom in 1896 by the British Aluminium Co., Ltd. The alumina is prepared near Larne, and then dispatched to Foyers, in Inverness-shire, and to Kinlochleven, Argyleshire, where abundant water-power enables electricity to be generated cheaply. There were 11,716 tons of bauxite of the value of £3,025 raised in the year. The output of British copper ore in 1908 showed a decrease of 1,351 tons compared with the previous year. In 1863 the production of copper ore and copper precipitate amounted to upwards of 210,000 tons, valued at over a million sterling. In 1908 the production was only 5,441 tons, valued at £25,053. The amount of copper obtained by smelting British ores is about one twenty-fifth, or 4 per cent. more than the amount calculated from the dry assay. Thus in the case of an ore containing 5 per cent. of metal by dry assay the actual yield has been taken at 5¼ per cent.

American Rubber Combine.—A Reuter telegram from America says that the amalgamation of the Continental Rubber Co. with the Inter-Continental Rubber Co. is announced under the name of the latter with a capital of $40,000,000. The new company will control a large part of the rubber industry in the Congo region.

The French Aluminium Combine.—A Paris dispatch to the *Financial News* says that the negotiations which have been proceeding for several months with a view to arriving at an understanding between aluminium works have failed, owing to the opposition to the scheme by a number of the principal firms.

Institution and Lecture Notes.—Leeds University Engineering Society.—Prof. T. W. Morgan, of Bristol University, recently brought before the Society the new "Knight" engine adopted by the Daimler Motor Co. He enumerated the difficulties which had been met with in the use of internal-combustion engines, due to heating and warping of the valves, and lubrication difficulties, and claimed that the Daimler people had now overcome these defects. The valves, which are the peculiar feature of the Knight engine, consist of two concentric sliding cylinders surrounding the piston, each having two ports at opposite sides, and the same end of the cylinder, and both having a travel of 1 in. The piston is inside the inner valve cylinder, and the outer valve cylinder is next to the fixed cylinder, which is enlarged for this purpose. Thus internal pressure does not increase the friction of the slide valves. The valve cylinders or sleeves are worked from eccentrics which revolve once for every two revolutions of the crankshaft. These sleeves may be made an easy fit on one another, the inner sleeve being the valve proper, and the outer sleeve the distributor. The inner one is made gas-tight at the explosion end by suitable metallic packing rings, so that there is no leakage during either the compression or the explosion. The explosive charge enters at one side and is exhausted at the other. It was mentioned that the cost of the valve-sleeve experiments had run into thousands of pounds. An interesting discussion followed the reading of the paper.

Röntgen Society.—The new president of the Society, Mr. C. E. S. Phillips, delivered his inaugural address on November 4th, devoting it partly to a general survey of recent developments in radiography and medical electricity, and partly to the description of a new arrangement of his own for measuring X-ray radiation, which he is to demonstrate at a subsequent meeting. Discussing, as a layman, the medical aspect of X-ray work, he said that the value of Röntgen's discovery in the field of medicine became more impressive as time went on. With the aid of the X-rays it was now possible, by watching the diaphragmatic movements with the fluoroscope, to detect tubercular conditions, and owing to the great transparency of the chest, especially during inspiration, not only could fluid be seen in the thoracic spaces, but even the ripples on its surface following a change in the position of the body could be noted. He went on to refer to the researches of Mr. C. A. Sadler upon the problem of secondary radiation, and said that in all the talk about radioactivity the share which England had in its discovery was overlooked, and all the credit given to France. Prof. Silvanus Thompson, working on different lines from those of Becquerel, discovered the phenomenon at about the same time as the French investigator. The atomic weight of radium, according to Thorpe, was 226·7, which was fairly well in accord with Mme. Curie's latest number.

Institution of Electrical Engineers (Leeds).—In the course of his inaugural address, the chairman, Mr. W. M. Rogerson, stated that ten years ago 93 municipalities had established electric generating stations, having a total capital of £5,734,938, while some 70 companies were also undertakers with a total capital of £5,261,763. At the end of 1908, the latest date up to which the returns are available, there were 541 undertakings, 338 of which belonged to local authorities and 203 to companies or private individuals, the total capital involved being £40,016,300 and £40,722,000 respectively. It will be seen, therefore, that the capital laid out both by private companies and local authorities has increased in about equal proportion. The total lamps connected, equivalent to 8 c.p., ten years ago were 4,106,727, which have now increased to 35,056,700, while the output in Board of Trade units sold both by companies and municipalities has increased in ten years from 60,125,500 to no less than 749,594,200. In 1898 only some 40 electric tramways were in existence, with a capital of approximately £24,000,000, while from the latest returns there are at present 305 undertakings in the United Kingdom, with a capital of £68,199,918, the gross receipts being £12,439,625, while the total number of passengers carried per annum amount to the large total of 2,625,532,895.

P. and O. Batti-Wallahs' Society.—The Birmingham Section of this Society held their second entertainment of this season in the Grosvenor Room, Grand Hotel, Birmingham, on Friday, November 5th, in the form of a Bohemian Concert. There were between 200 and 250 ladies and gentlemen present, including many gentlemen well known in the electrical and engineering profession. The evening was a most enjoyable one. The chairman, Mr. J. P. Kemp, in his remarks appealed to all Batti-Wallahs who were also members of the Institution of Electrical Engineers, to endeavour to be present at the dinner of the Birmingham local section on Friday to welcome and support the chairman—Mr. R. K. Morcom—who was also a Batti-Wallah, and was present with them that evening. The next function of this local section is to be a ball at the Grand Hotel, and the probable date is Friday, December 17th.

Institution of Electrical Engineers (Birmingham).—The first meeting of the Session was held at the University of Birmingham on Wednesday last week. The retiring chairman (Dr. Kapp) stated that the Council of the Institution had agreed to extend the area of the Birmingham Local Section, to include the whole district within a radius of 50 miles, with the exception of Nottingham and the Potteries. This had the effect of increasing the membership from 330 to 401. The chair was then taken by Mr. R. K. Morcom, and a vote of thanks was accorded to Dr. Kapp for the able way in which he had acted as chairman during the past two years, after which Mr. R. K. Morcom read his address (reported elsewhere in this issue).

Physical Society's Exhibition.—The date of the annual exhibition held by the Physical Society of London, which was fixed some time ago for December 10th, has been altered to Tuesday, December 14th, so that the exhibition may be open in the afternoon as well as in the evening.

Mr. Thomas Humphreys, M.I.E.E., has delivered a lecture on "A Discussion on Electrical Difficulties" to the members of the Rochdale and District Motive Power Mutual Improvement Society.

Institution of Municipal Engineers.—A meeting is to be held at Norwich to-morrow (13th) to form the District Committee for District No. 4.

Institute of Marine Engineers.—At the nineteenth annual dinner of the Institute last week, the President, Mr. James Denny, occupied the chair, and some 330 members and guests were present. A handsome presentation was made to the founder and hon. secretary, Mr. James Adamson. Replying to the toast of "Kindred Associations," Mr. W. M. Mordey, president I.E.E., recalled the fact that as long ago as 1882 he helped to put into the old *Colossus* an installation of arc lighting, which was, he thought, the very first example of electric lighting of a warship in the world. Since then the applications of electricity on board ship had extended until the lighting had become a matter of minor importance, and the question of adopting electricity even for the propulsion of the ship itself had been brought forward, great advantages being claimed for the use of electrical gearing between high-speed engines and low-speed screws. The provision of an economical heat engine was not an insoluble problem, and he believed that the end of this century would see steam disappear. The engineers of this country had always been, and still were, pioneers; the engine used by Fulton was a Watt engine, built at Soho, near Birmingham, and the work of Parsons had brought about the most profound change in marine engineering of later years. An electrical carriage was run by Davidson on the Aberdeen and Glasgow railway between 1839 and 1842.

Faraday House Old Students' Association.—A smoking concert and "At Home" will be held at Faraday House, Southampton Row, London, W.C., on Friday, December 3rd, from 8 to 11 p.m. Dr. Alexander Russell, M.A., the new Principal of Faraday House, will take the chair at the concert.

Trade in October.—The trade returns for the month of October show an increase of £1,905,477 in imports, £923,192 in exports, and £518,983 in re-exports, as compared with the same month in 1908. For the 10 months there is an increase of £15,902,148 in imports, a decrease of £7,402,496 in exports, and an increase of £10,181,804 in re-exports, over the same months in 1908.

American Competition.—At the meeting of Messrs. R. & J. Dick, Ltd., belting manufacturers, Glasgow, it was announced that the board had acquired a site in New Jersey (United States), where they would erect a belting factory of even greater capacity than the Glasgow works. The heavy tariff of 35 per cent. on their belting entering the States had forced the company to erect an American mill.

(*Continued on page* 786.)

DR. GISBERT KAPP.

The new President of the Institution of Electrical Engineers was born at Mauer, near Vienna, in 1852. He received his technical education at the Zurich Polytechnic School under Zeuner and Kohlrausch. Both this training and his first practical experience were in mechanical engineering. Coming to England in 1875, he specialised at first in the design of centrifugal pumping plant with Messrs. Gwynne & Co., subsequently travelling on the Continent for another mechanical engineering firm.

Dr. Kapp's connection with electrical engineering commenced in 1882, when Col. Crompton appointed him engineer of the Chelmsford Works. The designing of dynamos was then in a chaotic state, and Dr. Kapp soon established his reputation for original investigation in the subject. He found that the best method of acquiring critical knowledge was to prepare papers for the instruction of others. At that time the bulk of the literature available on dynamos was of an academic character, whereas the early papers by Dr. Kapp appealed at once to the practical man. The confusion over the design of dynamos was due to ignorance as to the magnetic circuit. The scientific principles were known to theorists, and had been expressed in abstruse mathematical formulæ, but the application of these principles to dynamos was not seen either by theorists or practical engineers. Dynamos were made with insufficient iron, and the iron parts, as in the Edison Jumbos, were too long and too thin. It was to Hopkinson and Kapp that the alteration in this state of things was due. Dr. Hopkinson greatly improved the magnetic circuit of the old Edison dynamo, and explained his reasons in a difficult paper read before the Royal Society, and buried in its *Transactions*. Dr. Kapp independently introduced the same improvement, and, what was more important, made quite clear to electrical engineers the essentials in the design of a magnetic circuit. The term "magnetic resistance," introduced by him, made the magnetic circuit simple to understand, and his methods of calculation were universally adopted. His earliest papers were presented to the Institution of Civil Engineers. The one on "Modern Dynamos and their Engines," in 1885, gained the Telford premium and medal; it was followed by others on the design of alternators and electrical apparatus. These showed the power of the author to grasp the fundamental principles involved, and to make his reasoning as clear to others as to himself. These papers, and Dr. Kapp's book on "Electric Transmission of Energy," published in 1886, were read with eagerness, and provided information which enabled others to design with certainty machines to fulfil given conditions. It must be remembered that this information was published at a time when the general tendency was to keep all electrical data secret. Generous frankness has characterised Dr. Kapp's professional career throughout, and he is still an emphatic Free Trader.

When the number of electrical manufacturers increased and competition in prices ensued, his opinion was that the designer should meet this by the more economical use of material rather than by cutting down labour charges. The multipolar type of direct-current dynamo was introduced by him in 1889, and for some years he alone in this country defended this type when other designers were straining the possibilities of bipolar machines. The multipolar machines in the municipal electricity works at St. Pancras were the first of their type, and, in spite of cast-iron field magnets, fulfilled their guarantees. Dr. Kapp was then practising as a consulting engineer in Westminster, and was responsible for several large electrical undertakings. The Corporation Electricity Works at Bristol were designed by him as joint consulting engineer with Sir W. H. Preece.

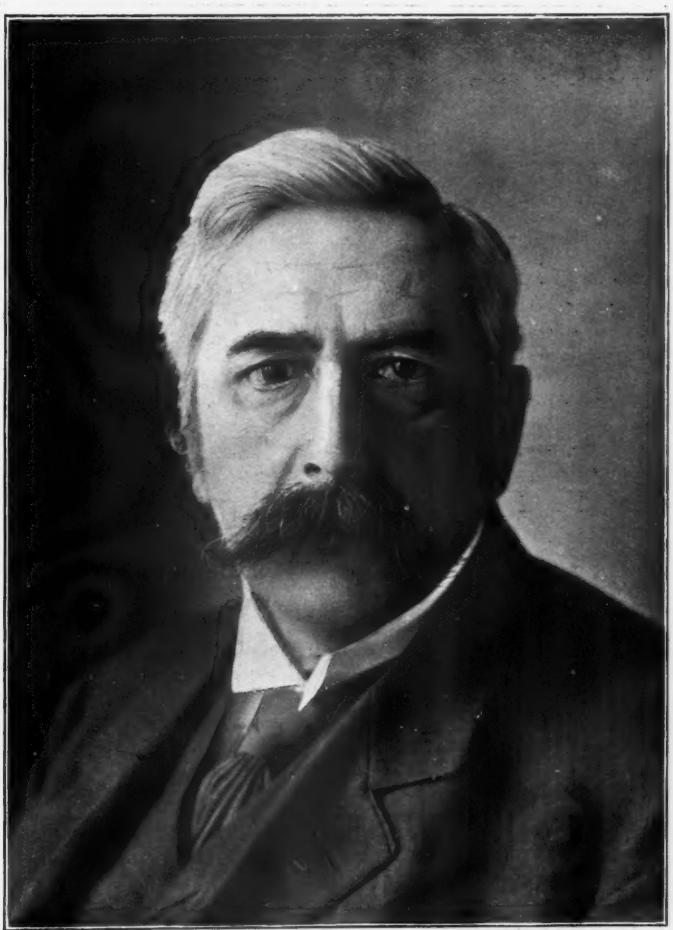


Photo by] [Lafayette, Manchester.

Gisbert Kapp.

Dr. Kapp's engineering works and publications, together with his wide knowledge of languages, kept him in close touch with engineers abroad, who frequently consulted him over questions of design. In 1894 he was invited to act as secretary of the Verband Deutscher Elektrotechniker, which was formed by the leading German engineers to assist in the standardisation of electrical practice throughout the German Empire. With the co-operation of the large manufacturing firms standards for the rating of plant, electric lamps, copper conductors, &c., were drawn up. Rules for electrical installations and for the protection of the public from overhead lines were also prepared, which have since been accepted by the majority of the German States. This avoided the confusion which would have arisen had each State acted independently in the preparation of local regulations. More than technical skill is required from the secretary of such a society to accomplish work of this nature, which is wrecked if professional jealousy is aroused. Dr. Kapp's tact and personal influence, coupled with the fact that he was independent of any of the large German firms, carried this work to a successful issue. These regulations and machinery ratings are now accepted in most of the European countries.

While acting as secretary of the Verband, Dr. Kapp was also free to practise as a consulting engineer, and here again

his expert advice was widely sought, both as arbitrator and as designer of schemes for power, lighting and traction. The cosmopolitan nature of his practice was unique. Thus, Moscow, Trondhjem, Trieste, Leipzig, are amongst the towns he advised, and he was frequently called to Switzerland and Italy. When the electrification of the Underground Railways in London was under consideration, he gave evidence as to the possibilities of the Ganz system, and his support in 1901 of a high-tension system for railway working has been justified by subsequent developments.

Again, he was consulted as to the transmission of power from the Zambesi Falls to the Rand Gold Fields, and advocated the continuous-current series system at 100,000 volts as most suitable for the purpose; but the commercial possibilities of such a scheme depend on the price of coal on the Rand.

While living in Berlin Dr. Kapp lectured on the subject of electrical design at the Technical High School, Charlottenburg, where the practical nature of his instruction was highly valued. In 1905 the University of Birmingham offered him the new Professorship of Electrical Engineering, which he now holds. Before he left Germany, the Universities of Dresden and Karlsruhe each conferred on him their honorary degree of Doctor of Engineering. His welcome back to England showed the hold he possessed, and still maintains, over those who worked with him in the earlier day of electrical engineering. Dr. Kapp's genuine hospitality makes many friends, and his kindliness, combined with absence of "side," extends his list of friends to all classes. His capacity for hard work is accompanied with the power of encouraging others to exert themselves and of extracting the best efforts of all associated with him. His recreations are music and sailing.

Elected an Associate of the Institution of Electrical Engineers in 1877, and a Member in 1883, Dr. Kapp has now attained the highest honour that it is in the power of the Institution to bestow—a post which he will assuredly occupy with dignity and ability worthy of his illustrious predecessors in that office. —R. W. W.

Hamo Thornycroft's Bust of the Late Dr. John Hopkinson, F.R.S. Presented to the Institution of Electrical Engineers by Mrs. Hopkinson.

New Electrical Showrooms.—The Brompton and Kensington Electricity Supply Co., Ltd., has opened showrooms and offices at 254, Earl's Court Road, S.W.—in a central situation in its area of supply and in close proximity to Earl's Court Station—where there are on view the latest improvements in electric lamps, fittings, and cooking and heating appliances. An electric kitchen is furnished with the latest electric cooking utensils, and demonstrations of cooking, ironing, &c., will be given as desired. The company's offices, in Richmond Road, are now closed, and all communications must be sent to the new address.

BUST OF THE LATE DR. JOHN HOPKINSON, F.R.S.

At the opening meeting of the Institution of Electrical Engineers, held at Westminster last night, members were privileged to take part in one of those interesting functions which help to keep green the memory of past leaders in the chair. There have been few greater presidents of the Institution than Dr. John Hopkinson. Twice—in 1890 and in 1896—he occupied that exalted office. Not only was he eminent in research and discovery and in inventions of enormous practical service in the development of the electrical engineering industries, but he was a president of charming affability and dignity, with a reputation absolutely unsullied among his contemporaries and others in the profession.

Among the various services rendered by him, one remembers in such times as these the characteristic energy with which he devoted himself, at a period of some national excitement and alarm, to the organisation of trained electrical engineers for volunteer service. It is the direct result of his initiative and interest in this matter that we have the electrical engineers fully equipped to-day for defence should occasion arise.

Dr. John Hopkinson was a leader whom we could ill afford to lose, but it will be recalled how his splendid career was cut short by an event which came as a shock to all who knew him throughout the entire electrical world. The details of the holiday in Switzerland, and its untimely termination, there is no need to dwell upon here. Since 1898 Mrs. Hopkinson has made very many valuable gifts to electrical education which will perpetuate the memory of her late husband, but the bust which will now stand in the premises of the Institution is a fitting form in which to keep before the minds of those who attend the London meetings the very fine abilities and qualities that were possessed and exercised by a former noted occupant of the presidential chair.

The presentation was made by Prof. Bertram Hopkinson, of Cambridge University, on behalf of his mother.

The Electrical Review is placed under a debt of gratitude to Mr. Hamo Thornycroft, R.A., for granting facilities for photographing the marble bust as it stood in his studio at Kensington. Mr. Thornycroft's record as a sculptor is of such world-wide renown that we are sure Mrs. Hopkinson could not have made a more excellent selection of an artist for carrying out her wishes.

BROWN-BOVERI TURBINE PLANT AT BUENOS AYRES.

The new power station which the "Deutsche Ueberseeische Elektricitäts Gesellschaft" (German Trans-Atlantic Electricity Co.), of Berlin, are erecting in Buenos Ayres will, when completed, be one of the largest power stations in the world. The supply of electrical energy for the various undertakings in Buenos Ayres which are owned or leased by the above company will be effected in the future entirely from this station, which is situated on an arm of the Dock Sud immediately outside the boundaries of Buenos Ayres. Its generating capacity will eventually exceed 110,000 H.P., and some idea of its dimensions, when completed, will be gathered from the outline drawings of the engine room, &c., shown below and on page 783.

When complete, this station will contain ten turbo-alternator sets, each of 7,500 KW., and in addition several smaller sets, and the first instalment of this equipment, consisting of five turbo-alternators of 7,500 KW. and two turbo-dynamos each of 1,000 KW., is now being erected.

extra alternator; a tandem arrangement for the 1,000-KW. turbo-dynamo sets was adopted on account of the D.C. supply pressure, which is 2 × 230 volts.

Fig. 1 shows the first of these large turbo-alternator sets to be completed, this particular plant having been shipped from the Mannheim works to Buenos Ayres in November last; figs. 3, 4 and 5 show one of the alternators in various stages of construction, and give a good idea of the

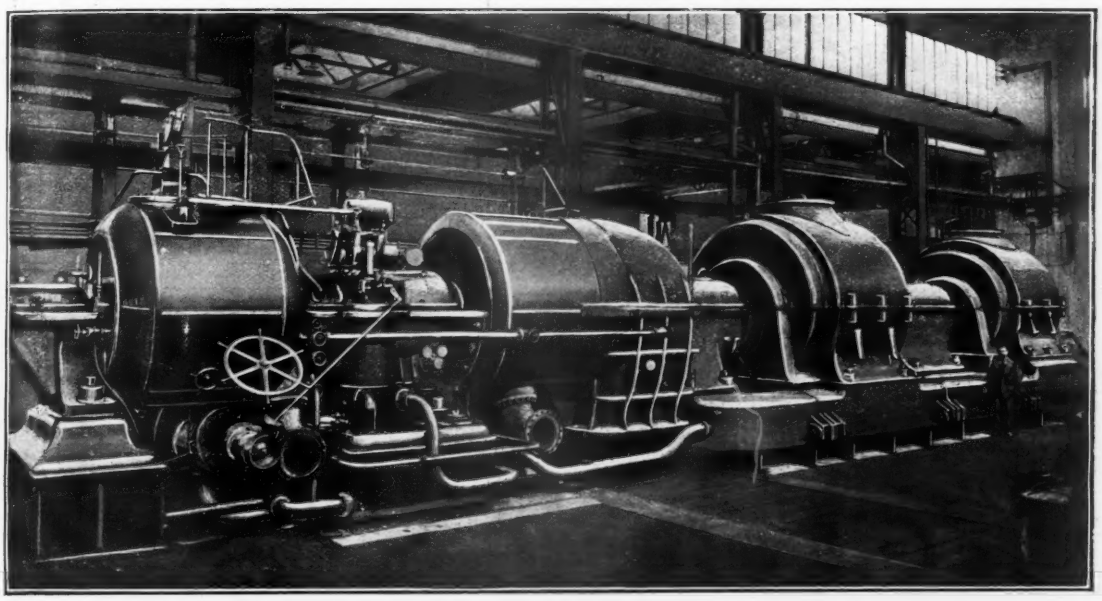


Fig. 1.—Steam Turbine of 11,000 H.P. Coupled to Two Alternators, each of 7,500 KW. at 750 R.P.M.

dimensions of the parts. As will be seen from the illustrations, the alternators embody in their construction (for instance, with regard to the method of ventilation and of field-magnet construction) the features of design which were originally introduced by Brown, Boveri & Co. about 1902, and which have now become almost standard practice with every maker. The machines are totally enclosed, with the exception of chimney-shaped openings at the top and bottom of the armature casing, and of an air-trunk at each end. Cool, clean and dry air is drawn up these trunks for ventilating

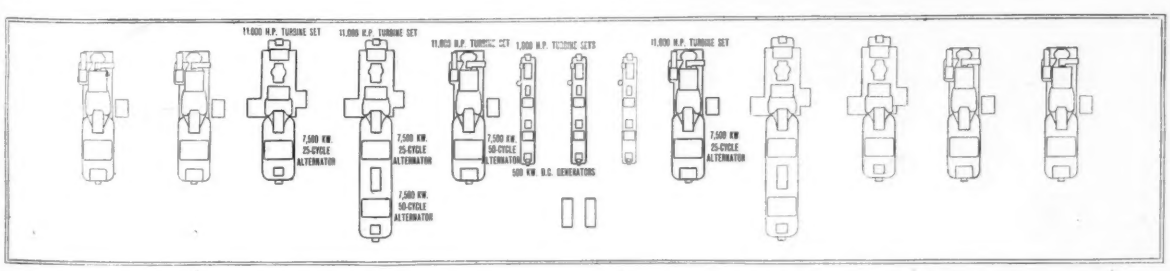

11,000 H.P. TURBINE SET
7,500 KW. 25-CYCLE ALTERNATOR
11,000 H.P. TURBINE SET
7,500 KW. 25-CYCLE ALTERNATOR
7,500 KW. 50-CYCLE ALTERNATOR
11,000 H.P. TURBINE SET
7,500 KW. 50-CYCLE ALTERNATOR
1,000 H.P. TURBINE SETS
500 KW. D.C. GENERATORS
11,000 H.P. TURBINE SET
7,500 KW. 25-CYCLE ALTERNATOR

Fig. 2.—Plan showing Prospective Arrangement of Generating Plant at the New Power Station at Buenos Ayres, the First Installation being shown in Heavy Lines.

The order for all the generators, which include six 7,500-KW. alternators (two 50-cycle machines and four 25-cycle machines) and four 500-KW. dynamos, was placed with Messrs. Brown, Boveri & Co. The five steam turbines are of the Brown-Boveri-Parsons type, two having been built at Messrs. Brown, Boveri & Co.'s Mannheim works, and three (to the same drawings) at the works of Messrs. Franco Tosi, of Legnano. One of the turbo-alternator sets consists of a turbine of 11,000 H.P. driving both a 25-cycle and a 50-cycle-alternator, each of 7,500-KW., which accounts for the purposes, which, after circulating through every part of the armature and field system, is expelled from one or other of the discharge openings—in this case the upper one, the lower opening being closed up. This nearly total enclosure (taken in conjunction with the perfect and permanent balance readily obtainable with the Brown, Boveri cylindrical construction of the field magnets) enables the machines to work with a negligible amount of noise, as the warm air can get away without any throttling through the single large opening provided for the purpose.

The core of the cylindrical field system is formed of steel plates—separated from one another by distance pieces to allow of free ventilation between them—built upon a hollow hub of forged steel (machined inside and out), into the ends of which the shaft-ends are shrunk. The winding consists of former-wound coils composed of copper strip, wound edgewise, which are placed in slots machined in the core for their reception, the coils being held in these slots by means of metal wedges in such a way that radial movement due to centrifugal force or expansion is an impossibility. The ends of the windings

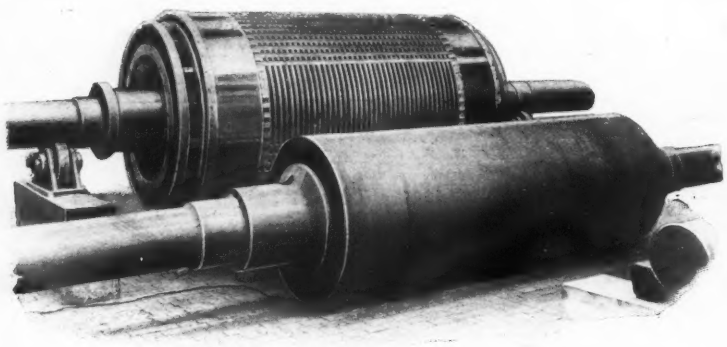


Fig. 3.—Complete Field-Magnet System for 7,500-kw. Alternator, showing (in Foreground) the Steel Hub and Shaft on which the Field Core is Built up.

projecting over the field magnet core are secured in position by caps of non-magnetic metal, to which are attached the impellers for forcing cooling air through the machine, as above referred to. These impellers, which, in conjunction with the casing, constitute a proper fan system at each end of the alternator, are so dimensioned and arranged that an ample supply of ventilating air (drawn up through the air trunks from the engine-room basement or from outside) is forced through the field and armature cores, and through the

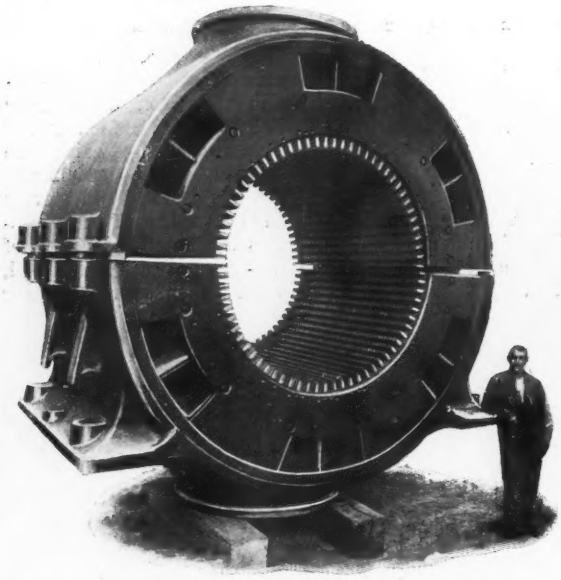


Fig. 4.—Armature Casing and Core for 7,500-kw. Alternator, Ready to Receive Windings.

end windings, the air being made to travel along well defined paths before it is discharged to the atmosphere, and in fig. 4 will be noticed the baffle plates and air channels in the armature casing, which partly serve for this purpose. The complete field system of one of these alternators, together with one of the hubs, is shown in fig. 3.

The armature core is built up between heavy end plates in the casing, a large annular space existing between core and casing, which forms one of the principal airways through the machine, and a great number of radial ventilating ducts being provided throughout the entire length of the core. Slots with parallel sides are provided along the internal periphery of the core for the reception of the windings, which consist of former wound rectangular coils, built up on the "solid system" in accordance with the maker's usual practice with this class of work. The coils are held firmly in position in the slots by means of hardwood wedges, which run the entire length of the armature core along grooves left in the teeth for the purpose. As will be observed from fig. 5, very great care is taken with regard to the clamping of the coil ends of these armatures; heavy gun-metal clamps are used for this purpose which, together with their bolts, are thoroughly insulated from the windings by blocks and tubes of compressed insulation.

The slip rings are of steel, faced with copper, and are provided with carbon brushes. In accordance with Messrs. Brown, Boveri & Co.'s usual practice, they are placed one at each end of the field system; very great care is taken with the connections from the field coils to the rings, these connections being of heavily insulated stranded conductor positively held throughout their length.

The normal rating of these alternators is 7,500 kw. at a power factor of 0·8—0·9 when running at a pressure of 12,000—13,000 volts and a speed of 750 r.p.m. At this rating the temperature rise is 40—45° C. after a long continuous run. The weight of a single generator complete, but without bedplate or bearings, is 73·5 tons, the armature weighing about 48 tons, and the field system about 25·5 tons.

In the case of the two alternators in tandem, separate bedplates are provided for each, these being fitted and bolted together, as shown in fig. 1.

The steam turbines, driving the alternators described above, are constructed for a continuous output of 11,200 h.p. at a speed of 750 r.p.m., and are capable of giving an output of

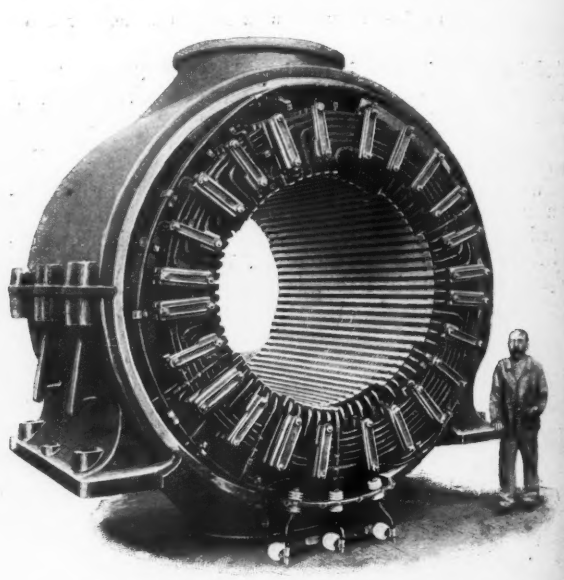


Fig. 5.—Complete Armature System, with End Covers Removed, of 7,500-kw. Alternator.

14,200 h.p. for at least two hours under normal steam conditions, that is, with a steam pressure at the stop-valve of 180 lb. per sq. in. and a steam temperature of 572° F. The turbines, which are all of the Brown, Boveri-Parsons type, have two cylinders—high and low pressure—with a bearing between them. This arrangement has been adopted by the designers with a view to obtaining greater economy in steam consumption and to allow a greater number of blade rows to be fitted, and with it all shaft troubles, even with widely varying temperatures, disappear.

The turbine rotor consists in each case of a forged steel

drum, into the extremities of which the shaft ends are shrunk and locked by means of bayonet keys. Heating channels are provided at the steam inlet end of the drum, so that uniform heating of the entire rotor is obtained, while the high temperatures are confined to the comparatively short high-pressure cylinder, so that the expansion effects due to these high temperatures are reduced to a minimum. To balance the thrust, dummy pistons with labyrinth packing are provided. The piston which balances the thrust of the low-pressure expansion (and which in the earlier type of Parsons' turbines was very large) is built on the low-pressure end of the rotor, in accordance with Fullagar's patent. The two rotors are coupled together by a flexible coupling, a small intermediate thrust bearing being provided.

The relay for the double-beat controlling valve is operated by means of oil under pressure instead of steam, this being a special feature lately introduced by Messrs. Brown, Boveri & Co. in their large turbines. The oil for this purpose is supplied from the general lubrication system, and one of the advantages of this method of governing is that, should the lubrication fail, the turbine will be automatically stopped.

The centrifugal governor working on the relay is driven by helical gear from the vertical shaft from which one of the oil pumps is also driven, and on this same shaft there is an emergency governor, set to act when the speed increases above the normal by 15 per cent., in which case the double-seated inlet valve would be closed in the usual manner.

On the other side, and symmetrical with this shaft, is a second oil pump, driven by the same helical wheel. This second oil pump works in parallel with the first pump, and supplies oil for general lubrication at a pressure of 22 lb. per sq. in. The normal steam consumption of these turbines

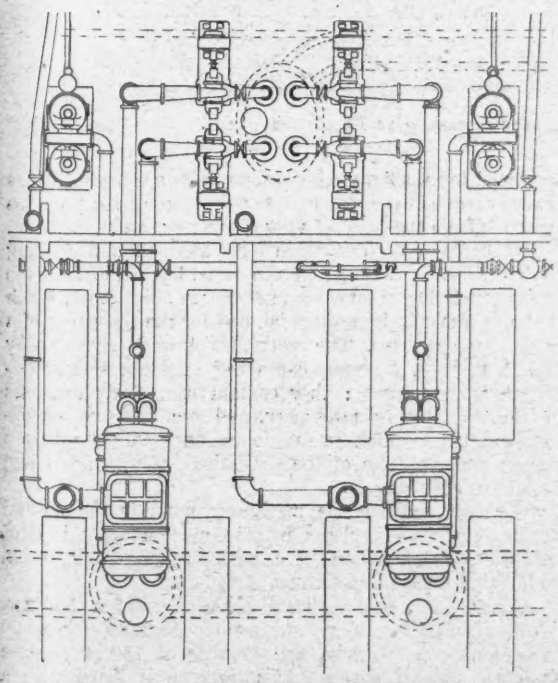


Fig. 7.—Plan showing Arrangement of Condensing Plant for Two Turbine Units, Buenos Ayres Power Plant.

when working at a load of 7,500 KW. has been guaranteed not to exceed 6·3 kg. (13·9 lb.) per KW.-hour, the vacuum being 28·5 in. with the barometer at 30 in.

Each surface condenser has a cooling surface of 1,300 sq. m. (13,993 sq. ft.), and, when supplied with sufficient cooling water at 60° F., is capable of producing the above-mentioned

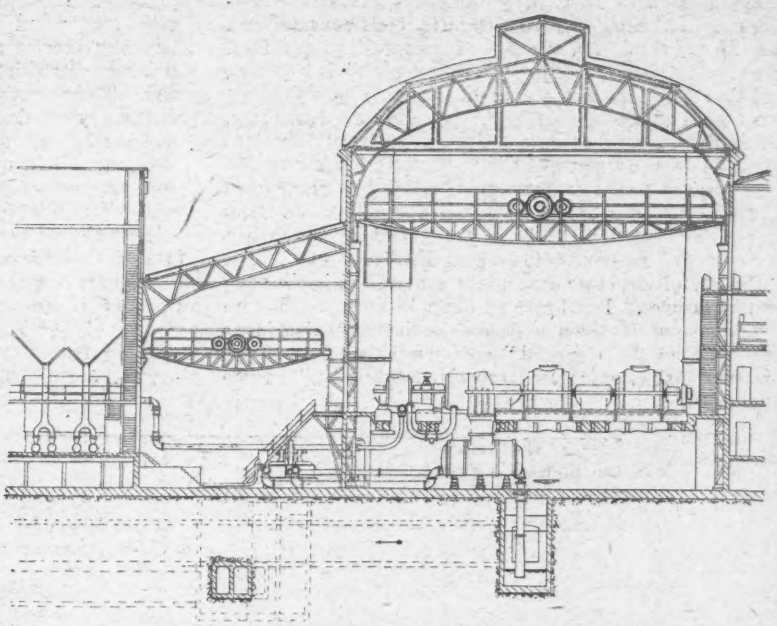


Fig. 6.—Section through Engine Room, Buenos Ayres Power Plant, showing Brown, Boveri Turbine.

vacuum when condensing 50,000 kg. (110,200 lb.) of steam per hour, while a vacuum of 27·2 in. will be maintained under these conditions when the condenser is supplied with cooling water at 77° F.

ELECTRIC DRIVING OF TEXTILE FACTORIES.

The following important communication came to hand after our "Correspondence" columns were closed. It will be seen that Mr. Woodhouse, who possesses experience probably unique in this subject, corroborates the views expressed in our "Note" on page 704 :—

The report issued by the Bradford Engineering Society on "The Electrical Driving of Textile Factories," appears to have been accepted in some quarters as being an authoritative pronouncement based on exhaustive tests, and backed up by the whole of the Committee. As this is certainly not the case, I venture, as the reader of the paper which was to some extent the cause of the formation of the Committee, but more particularly as a member of the Committee, to offer some explanation of the actual facts.

1. The Committee were not unanimous, and although I, myself, dissented from the form of the report, the Society have not thought fit to publish this fact.

2. The report is *not* conclusive, nor are many of the so styled "conclusions" based on any tests made by the Committee.

The report speaks of exhaustive tests, but it does not make it clear that the only comparative tests made were those of speed variation, and that of the two tests mentioned —at Dock Ing and Leigh Mills respectively—the latter (which is electrically-driven) showed the smaller speed variation.

The statement that (in the mechanically-driven mill) "the amount of cyclical variation was not so great as had been anticipated," is an example of the misleading way in which the report is worded. It suggests that the Committee were unscientific enough to form a previous opinion on the matter, which was certainly not the case. The majority of the Committee had never seen the mill, and the anticipations referred to were of unknown amount and

existed in the mind of some unknown person. I submit that a vague statement of this kind should have no place in such a report.

No figures were presented to the Committee on the relative output of mechanically and electrically-driven machines, but to say that "no evidence of increased output from electrically-driven machines *can* be supplied," is incorrect, and that "the Committee have been unable to obtain any proof based on actual experience" is more—it is misleading. Evidence of increased output due to electrical driving is available from all parts of the world, and I am sure that the statement to the contrary made above has never been formally agreed on by the members of the Bradford Committee, nor would it be by any unbiased person with a knowledge of the results of electrical driving.

Several of the other conclusions are worded in the same curious manner. I will take as example those which state "Where power is generated on the site the mechanical losses are less than the electrical" and "mechanical losses are excessive if the friction load exceeds 30 per cent." These are generalisations which have not even a single test to support them.

If the writer were disposed to generalise from the very large number of tests which he had made in woollen mills, he might with justice disagree with both of the above conclusions, but it is perhaps sufficient to point out that on such vital points as these the report furnishes conclusions without data—bricks without straw.

For the reasons given above I disassociated myself with the report, and I much regret that it should have been issued without fuller consideration.

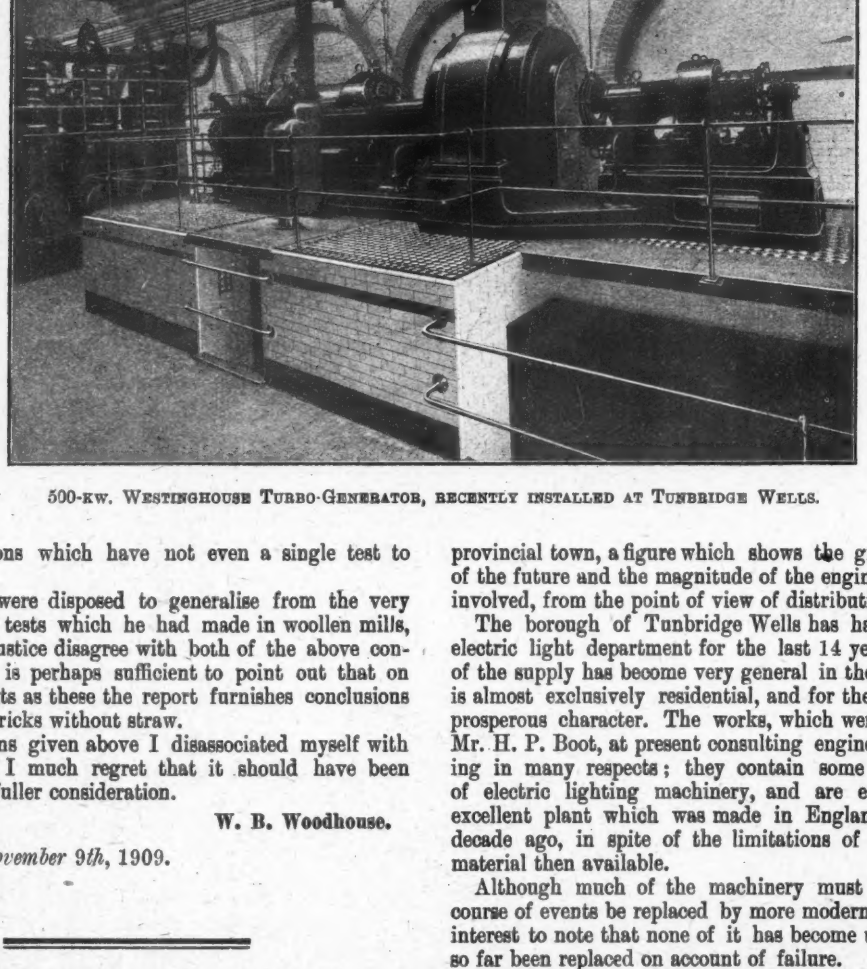
W. B. Woodhouse.

Thornhill, *November 9th*, 1909.

Copper.—The surprising fact about copper is that, in the face of huge visible supplies, the price continues to hold up. The total given in Messrs. Merton's circular for October 31st is 99,357 tons, an increase of 2,754 tons over the mid-monthly return, which increase is principally in the stocks of standard copper at Liverpool and Swansea, and the quantity afloat from Australia. In the supplies columns, America is up to recent average, though not up to average for the year. Spain is average, Chile slightly low, Australia fully average. A re-shipment of 75 tons from England to the States is noticeable.

TUNBRIDGE WELLS EXTENSIONS.

Descriptions of new generating plant, which formed an important feature of the technical papers a few years ago, have now become somewhat rare, particularly with regard to those undertakings which deal principally with a lighting load. There are signs, however, that the winter peaks will shortly show their familiar upward tendency again, and it may be safely assumed that when the lighting load really increases, due to new business obtained with the metallic lamp, the rate of growth will be far more rapid than in the past, for such business will come from those users of light who are obliged to consider the immediate and obvious cost of their necessities, and their number is in most towns enormously greater than that of the present domestic users of electricity—in spite of the great increase in the use of electricity during recent years. The proportion of dwelling houses taking the supply is generally found to be between 5 and 10 per cent. of the total in an average provincial town, a figure which shows the great possibilities of the future and the magnitude of the engineering problems involved, from the point of view of distribution at least.



500-kw. Westinghouse Turbo-Generator, recently installed at Tunbridge Wells.

The borough of Tunbridge Wells has had a flourishing electric light department for the last 14 years, and the use of the supply has become very general in the district, which is almost exclusively residential, and for the most part of a prosperous character. The works, which were originated by Mr. H. P. Boot, at present consulting engineer, are interesting in many respects; they contain some early examples of electric lighting machinery, and are evidence of the excellent plant which was made in England more than a decade ago, in spite of the limitations of experience and material then available.

Although much of the machinery must in the natural course of events be replaced by more modern types, it is of interest to note that none of it has become unusable, or has so far been replaced on account of failure.

A new plant, recently installed, consists of a 500-kw. Westinghouse-Parsons turbo-generator designed for 2,000 volts single-phase supply, and working at 150 lb. pressure with superheated steam. This machine is fitted with a high-pressure by-pass, allowing it to be loaded up to 750 kw. for short periods; its performance under tests carried out after erection was extremely good for a machine of this size, the principal figures, after corrections, being as follows, in lb. of steam per kw.-hour: pressure, 150 lb.; superheat, 100° F.; vacuum, 27½ in.:—

	Guaranteed.	Obtained.
¼ load	30·2	23·67
½ ,, ...	23·3	22·48
¾ ,, ...	20·8	19·58
Full load	19·6	18·81

The generator is of the revolving field type with radial collectors, the exciter also being fitted with the Westinghouse radial commutator and carbon brushes, which appear to be giving satisfaction at this relatively high speed (2,225 R.P.M.).

The condensing plant was supplied by Messrs. J. and P. Hall, and consists of a centrifugal circulating pump and air pump of the Edwards type, driven directly by a 30-H.P. single-phase Fuller motor. The whole plant is compactly arranged on concrete work and finished with vitrified tiles. The pipe work, carried out by Messrs. Spencer & Co., is arranged to permit of the reciprocating sets in the station, and the turbine being worked either with the electrically-driven condensing plant or the original steam equipment.

The steam-raising plant, consisting of water-tube and Lancashire boilers, is being modernised, and underfeed stokers and Hotchkiss circulators are about to be installed. At the present time hand firing with high-grade steam coal is practised, and there appears to be room for considerable economies in fuel costs, which will, no doubt, result from the use of the turbine and other improvements.

The mains system is, owing to the scattered character of the district, a very extensive one; armoured concentric cables are used throughout, the nature of the soil and light character of the local traffic rendering cable work comparatively inexpensive. Transformers are accommodated in underground chambers and pillars in the more recent work. At the present time several extensions are in progress, and the department is beginning to feel the benefit of the great cheapening of cost which has resulted from the extensive use of the metal-filament lamp. The Corporation does not exercise any trading powers, and the installation work is in the hands of local contractors, who, although not numerous, appear to be thoroughly alive to the possibilities of the district, and find ample reward for their efforts at the local rate of supply, 4½d. per unit. This figure compares with 2s. 8d. per 1,000 ft. for gas, and is distinctly in favour of electric lighting, and with the high-efficiency lamp opens out a great possible market for electric heating and cooking apparatus amongst the consumers, who are now finding their accounts reduced by many pounds per annum.

The supply of power, although small, constitutes quite a large proportion of the total in the district, several printing and photographic establishments being driven by electric motors, whilst tradesmen and the usual employers of small machinery help to form a day load on the station plant.

Public lighting by electricity has been carried out in this borough for many years, and recently great extensions have taken place—some 15 miles of streets being illuminated with Osram lamps and arc lamps; amongst the latter are a number of rectified lamps and other early types which are being gradually superseded by modern flame lamps.

On the occasion of completing the turbine extension, the chairman of the Lighting Committee, Mr. B. M. Woollan, J.P., invited the Council and a number of local residents to inspect the works.

The engineer prepared a booklet describing the undertaking and containing a quantity of illustrated advertising matter, and arranged with the local contractors to display lamps and fittings, heating stoves, cooking utensils and a "Tricity" cooker in operation, which were much appreciated by the visitors. Amongst the exhibits a new form of electrolytic rectifier calls for some attention; it is designed and made by Mr. Avery, of Fulmen Works, who is, so far as we are aware, the only electrical manufacturer in the district. The apparatus, which works on the principle of the Nodon valve, is combined with a voltage-reducing transformer, and has water-cooled elements; an efficiency of 80 to 90 per cent. is claimed, which should make the apparatus of interest to those who wish to charge accumulators off an alternating supply without the use of running machines.

Unfortunately, owing to indisposition, the chairman was unable to be present, and the guests were received by the Mayor, Councillor Caley, J.P., and the vice-chairman, Councillor Tylor. These gentlemen made a feeling reference to the valuable services which Mr. Boot had given to the undertaking during such a long period of years, and showed clearly how much it was to the interests of the town to develop the business, and the great extension in the use of electricity which might be anticipated as the result of recent improvements and the comparatively low rate charged for the supply.

Our thanks are due to the resident engineer, Mr. J. W. Beauchamp, for details of the undertaking, and the photograph reproduced herewith.

A CURIOUS INCIDENT IN CENTRAL STATION LIFE.

Curious Motoring Incident.

[Extract from *The Motor* of October 19th].

Motorists who have occasion to travel at night in country districts are familiar with the sight of the wild rabbit disporting itself in the glare of the headlights, oftentimes with disastrous result to itself; and in this connection a curious incident is reported from Cumberland.

On Wednesday night, September 29th, about nine o'clock, while Dr. C. Crawford Aitken, of Carlisle, was motoring in the vicinity of Cotchill, some six miles out from Carlisle, a well-grown rabbit ran in front of the car, a 15-H.P. Humber, and disappeared from view, apparently run over. On search being made no signs of it were to be found, and it was assumed that it had managed to make its way to the hedge.

Next morning, on lifting the bonnet of the car preparatory to starting, the chauffeur was astonished to find the animal seated on the top of the carburetter alive and well. It had evidently jumped in through the small space between the radiator and number plate notwithstanding that the car was moving at nearly 20 miles an hour and it had maintained its position amid the operating levers of the carburetter and synchroniser during the whole run of six miles into Carlisle. It appeared to be perfectly unhurt, though a quantity of fur adhering to the under surface of the radiator and to the governor spindle and electrical connections showed it to have sustained a rough passage inside the bonnet. It was later in the day set at liberty. Fact.

Shift engineers who have occasion to sit up late at night watching the wheels go round, frequently are in the habit of causing the long night hours to pass more pleasantly by indulging in the companionship of the station cat, and in this connection one of the engineers of the Hammerlebone Urban District Council's station in London has an interesting story to tell.

Some six months ago—to be precise, on Wednesday night April 19th—while Mr. Busbar Thompkyns was going his rounds about 11 p.m., preparatory to turning in on top of one of the boilers, he noticed the station cat playing with a large mouse, which, after several efforts at escape, finally bolted through the boiler house door, and fell into the hot well, while pussy, in hot pursuit, was unable to stop her headlong career, and was also precipitated into the same watery abyss.

Mr. B. Thompkyns exhausted himself and every form of fireman's implement (including a garden rake) in the endeavour to save his feline friend, but after prolonged efforts was obliged to desist and return to his duty (in the boiler house).

A remarkable sequel to the story has recently developed during the overhaul of the Hammerlebone steam turbines preparatory to the heavy winter and Christmas loads.

Mr. Busbar Thompkyns was on dayshift, and in charge of this work, and was standing by No. 2 turbine, while the cover was being lifted. Imagine his amazement after the cover had been raised some little distance, when he observed pussy sitting up contentedly in the space just in front of the low-pressure blades, cleaning her face with her paws and ministering to the wants of a family of seven kittens.

Pussy appeared to be quite unhurt, though a quantity of fur adhering to the high-pressure blades (and also further quantities subsequently found in the boiler-feed pump and superheater) showed her to have sustained a rough passage from hot well to turbine.

The kittens were all in excellent health, but pussy herself (who, we understand, had been found eating boiler

composition on previous occasions), though in good health, appeared rather thinner than usual. Mr. Thompkyns is inclined to attribute this to her strict attention to family duties, and to the great heat of the past summer: in fact, he points out that there are distinct evidences that she spent the earlier part of her sojourn in the turbine under the double-beat steam admission valve, but was forced to move further down the turbine as the summer heat increased.—X.

NOTES.

(*Concluded from page* 778.)

Olympia Motor Exhibition.—Although the eighth International Motor Exhibition, which opens at Olympia to-day and closes on November 20th, does not, so far as one can see, present any particular novelty in electric cars, there is every promise of a fine display of petrol cars and a sprinkling of novelties in the shape of valveless and piston valve engines, transmission apparatus, &c. As usual, the galleries will be devoted to accessories, including ignition apparatus *ad lib.*, electric lamps, sparking plugs, accumulators, electric horns, speed indicators, ball bearings, chains, and the thousand and one details which have been evolved for the convenience of the motorist. One feature which appears to be more pronounced this year is the display of electric generating apparatus for car lighting, and, generally speaking, the Exhibition contains a good deal which will interest engineers and electricians.

What is an Electrician?—The following little incident, witnessed by a correspondent a few days ago, might, he says, be a practical solution of the never-ending inquiry, "What is an electrician?" He was in an auction mart in a well-known seaport in South Wales. The auctioneer was a very smart and witty man, and kept the audience in a good humour with his jokes. The main object of his witticisms was the showman, whose duty it was to take the goods round and show them before they were put up for auction. This showman went by the name of Smelter. The mart was very brilliantly lighted, and in the midst of proceedings all the lights went out except one small row at the back of the place. The auctioneer explained to the audience that the volts had become too high and so burnt the fuse; but Smelter would soon put it right; he was a very handy man, Smelter was. Smelter in the meantime was fiddling with the distribution board, when, bang! a huge report, and all the remaining lights went out. "There you are," exclaimed the auctioneer; "I told you so. Smelter is an electrician now; he puts the blooming lot out!"

Birthday Honours.—The list of Birthday Honours published this week is practically devoid of interest from our point of view. The new Privy Councillors include Sir Edgar Speyer, Bart., of financial renown and underground electric railway experience, and Sir Henry Roscoe, F.R.S., the celebrated chemist. Mr. W. J. Crossley, M.P., chairman of the well-known firm of Crossley Bros., Ltd., gas engine builders, &c., of Manchester, becomes a baronet, and Sir William has the hearty congratulations of the Electrical Review upon the honour thus conferred. A knighthood raises the director and superintendent of ordnance of Vickers, Sons & Maxim, Ltd., to the title of Sir Arthur Trevor Dawson, to whom also we offer congratulations, and a similar honour changes the description of a well-known motor-car manufacturer to Sir Charles Friswell. Prof. W. A. Tilden, D.Sc., F.R.S., the eminent chemist, also becomes a knight. A C.B. is granted to Mr. G. R. Askwith, K.C., the Comptroller-General of the Commercial Department of the Board of Trade.

The Bodie Case.—The difficulty—we fear, the impossibility—of destroying the popular belief in "animal magnetism" as a curative agent, is well exemplified in the recent case in which "Dr." Bodie was compelled to refund £1,000 paid by a credulous youth for initiation into the mysteries of his so-called art. It is greatly to be regretted that the scientific evidence adduced was utterly inadequate, and, indeed, instead of constituting the principal feature of the case, was feeble and ineffective in the extreme. We do not wish to cast the slightest imputation upon the technical ability of the expert appointed by the judge, but the evidence that he furnished was of trifling value. A technical witness more experienced in the art of giving evidence could have shown with ease that the performances of the defendant were mere child's play; his claim to possess exceptional powers could have been torn to shreds, and the peculiarities of the phenomena observed with high-frequency currents could have been explained. The only satisfactory feature of the case was the intelligent decision arrived at by the jury, who rightly assessed the value of the defendant's claims, and thus exposed the fallacy of his demonstrations.

New Association.—We have received particulars of the British Association of Medical and Electro-Medical Instrument Manufacturers, which has just been formed. A number of the leading firms are connected with it already. Particulars can be obtained from the hon. secretary, Mr. Geoffrey Pearce, "Nairn," Avondale Avenue, Woodside Park, N.

Appointments Vacant.—Assistant electrical engineer (35s.) and switchboard attendant, for Fareham U.D.C. Junior lecture assistant in the Electrical Engineering Department at the Northampton Institute. See our advertisement pages.

Tramway Trolley Standards.—It will be remembered that a fatal accident occurred on May 21st on the Wolverhampton District Electric Tramways, when a man was found dead on the top deck of a car with his feet (on which were nailed boots) resting on the base of the trolley standard and the upper part of his body against the handrail. The Board of Trade has now issued a circular letter to tramway authorities, stating that its electrical adviser, Mr. A. P. Trotter, in the course of his inspection of the car, found signs of a considerable arc on the brass bolt by which the main cable was attached to the trolley head: arcing had taken place between this bolt and the trolley boom at a distance of only about ½ in. from the extreme end of the boom, at a place where it was not likely that there had been any mechanical abrasion of the insulation. Mr. Trotter was of opinion that the defect was probably due to a chip of metal in the taping with which the brass bolt was insulated. In addition to this defect, there was a failure of the red lamp warning, due to a discontinuity in the wiring of the lamps. On the car being stripped, the wire was found to be open-circuited behind one of the corner pillars.

Owing to the drawbacks attached to the red lamp warning, the Board of Trade has previously expressed preference for an audible signal; and as a result of the accident the Birmingham and Midland Tramways Joint Committee, which works the line, has decided to make a daily test to see that the trolley standards are properly insulated, and to equip all cars with a magnetic blow-out fuse giving a distinctly audible signal. Pending the adoption of an audible signal, the lamps should be bridged with a suitable fuse, and the signal device should be tested at least once a week; and authorities are requested to give the matter their careful consideration.

Non-Magnetic Wire.—In an article in the *E.T.Z.*, by R. Gans, a description is given of measurements which show that the enamel used by the A.E.G. for insulating wire has a magnetic susceptibility less than $29{\cdot}5 \times 10^{-6}$ in absolute measure. Wire insulated with this enamel can, therefore, be regarded as non-magnetic, even when employed in measurements of high precision.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Tramway Officials.—Mr. H. H. Lancaster, assistant manager of the Blackpool tramways, who has secured an appointment at West Ham with the Metropolitan Tramways Co., has been presented by the staff with an oak book-case bureau.

General.—Mr. G. W. Farrall, who has been for the last 22 years a member of the staff of the Electric Construction Co. at Bushbury, near Wolverhampton, and who has resigned his position in order to take up another appointment with the Midland Electric Power Co., was on Saturday evening the recipient of a gold watch and gold ring, as a mark of appreciation and goodwill from his old comrades. The presentation was made by Mr. W. Bullock, manager of the Electric Construction Co., at a complimentary dinner, followed by a smoking concert.

Mr. H. Herbert Cassé has resigned his position as director of the Bradford Electrical Co., Ltd., and has joined the firm of Mr. Charles Bell, The Ironworks, Bath Street, Leeds Road, Bradford, where he will have charge of the electrical department.

NEW COMPANIES REGISTERED.

Smith, Major & Stevens, Ltd. (105,693).—This company was registered on November 1st, with a capital of £50,000 in £1 shares (60 founders), to take over the business carried on at Janus Works, Queen's Road, Battersea, and elsewhere, as "Archibald Smith & Stevens," to adopt an agreement with C. G. Major, E. C. Stevens and P. H. Stevens, and to carry on the business of mechanical and electrical engineers, ironfounders, lift, machinery and boiler makers, &c. The subscribers (with one share each) are:—C. G. Major, 156, Bedford Hill, Balham, S.W., engineer; E. C. Stevens, Rivermead, Twickenham Road, Teddington; P. H. Stevens, 12, Holroyd Road, Putney, S.W., engineer; P. C. Major, 24, Regent Street, Coventry, engineer; W. Spyer, 65, London Wall, E.C., solicitor; Miss B. K. Stevens, 12, Holroyd Road, Putney, S.W.; C. D. Bishop, 123, Lavender Hill, S.W., medical practitioner. Minimum cash subscription, £100. The number of directors is not to be less than three or more than five; the first are C. G. Major, E. C. Stevens, P. H. Stevens and P. C. Major; remuneration of C. G. Major, £750 per annum; of E. C. Stevens and P. H. Stevens, £375 each per annum; of P. C. Major nil, until C. G. Major vacates office (afterwards, £375 per annum).

Feld Bros. & Co., Ltd. (105,577).—This company was registered on October 25th, with a capital of £5,000 in £1 shares, to acquire the business carried on at 432-433, Mansion House Chambers, E.C., as Feld Bros., and to adopt an agreement with F. W. Sichtermann and A. Feld, and to carry on the business of manufacturers of and dealers in electrical appliances, lamps, burners, fittings, radiators, batteries, cables, wires, accumulators, meters and engines, &c. The subscribers (with one share each) are:—F. W. Sichtermann, 17, Delaware Road, W., electrical engineer; A. Feld, 7, Ivanhoe House, Kenton Street, W.C., electrical engineer. Private company. The first directors are F. W. Sichtermann and A. Feld with £250 each per annum as remuneration. Registered office, 432 and 433, Mansion House Chambers, Queen Victoria Street, E.C.

Marbro, Ltd. (105,619).—This company was registered on October 27th, with a capital of £2,000 in £1 shares (1,500 preference) to carry on the business of manufacturers of electrical goods of all kinds, general merchants, &c. The subscribers (with one share each) are:—Mrs. L. Markt, Belmont, Stanhope Avenue, Finchley, N.; C. A. Sampson, 28, Rundell Road, Paddington, W., clerk. Private company. C. Markt is permanent director and manager, with remuneration as director, £27 6s., and as manager, £365 per annum. Table "A" mainly applies. Registered office, 22, Belsham Street, Morning Lane, Hackney, N.

Perth Traction and Development Co., Ltd. (105,787).—This company was registered on November 5th, with a capital of £10,000 in £1 shares, to acquire concessions, rights and privileges for the construction and laying down of tramways in Western Australia, and to carry on the business of tramway, railway, omnibus, traction, engine and van proprietors, manufacturers of and dealers in carriages, trucks, locomotives, accumulators and dynamos, &c. The subscribers (with one share each) are:—E. W. Lyons, 73, Florence Road, Stroud Green, N., F.C.I.S.; R. B. Holmes, 6, Binfield Road, Clapham, S.W., clerk; G. E. Bance, Ballencrieff, East Molesey, clerk; W. J. Routledge, 1, Thorold Road, Ilford, chartered accountant; H. P. Jones, 15, Crewdson Road, S.W., clerk; G. Kerr, Lochnago, Greenham Road, Muswell Hill, N., secretary; F. A. Holyfield, Heathercroft, Wanstead Park, secretary. Minimum cash subscription, 10 per cent. of the shares offered to the public. The first directors are A. H. P. Stoneham, O. Wethered, R. Popkiss and C. Wren. Registered office, 30-31, St. Swithin's Lane, E.C.

Silico-Bitumen Co., Ltd. (105,790).—This company was registered on November 5th, with a capital of £4,000 in £1 shares (2,000 6 per cent. cumulative preference), to carry on the business of bisumen manufacturers and merchants, contractors and agents, electric insulating compound manufacturers, electric fittings and accessory makers, asphalt and tar macadam, binder makers, &c. The subscribers are: J. Rickman, Blakemere, Weybridge, civil engineer, 10 preference shares; J. P. Rickman, 13, Walbrook, E.C., civil engineer, 100 preference shares. Private company. The number of directors is not to be less than two or more than five; the first are to be appointed by the subscribers; qualification, £100 shares or stock; remuneration, 50 guineas each per annum. Registered office, 13, Walbrook, E.C.

Brown & Murray, Ltd. (105,707).—This company was registered on November 2nd, with a capital of £1,000 in 900 preferred ordinary and 100 founders' shares of £1 each, to take over the business of manufacturers of telegraph machines, general machinists and engineers, &c., carried on by S. G. Brown and D. Murray, at Mildmay Park Works, Islington, as the "Telegraph Machinery Manufactory." The subscribers are: S. G. Brown, 4, Great Winchester Street, E.C., engineer, 1 pref. ordinary share; D. Murray, 8, Lombard Court, E.C., engineer, 1 pref. ordinary share. Private company. The first directors are S. G. Brown and D. Murray (both permanent managing directors); qualifications of ordinary directors £10; registered by Alfred H. Atkins, Ltd., 27-8, Fetter Lane, E.C.

Vactite Wire Co., Ltd. (105,696).—This company was registered on November 1st, with a capital of £450 in £1 shares, to take over the business of a manufacturer and supplier of accessories to the incandescelectric lamp industry at 50, Uxbridge Road, Ealing, as the Vactite Wire Co. The subscribers (with one share each) are:—L. J. Yeoman, 805-9, Salisbury House, E.C., chartered accountant; F. J. Hubble, 806, Salisbury House, E.C., clerk. Private company. The provisional directors are L. J. Yeoman and F. J. Hubble; qualification, one share. Registered office, 805-6-9, Salisbury House, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

La Capital Tramways Co., Ltd. (49,597).—Memoranda of satisfaction in full on September 17th, 1909, (*a*) of mortgage dated November 23rd, 1896, securing £120,000, of which £110,600 was outstanding on July 1st, 1908, and (*b*) of mortgage dated November 25th, 1898, securing £150,000, of which £142,100 was outstanding on July 1st, 1908, have been filed.

La Capital Traction and Electric Co., Buenos Aires, Ltd. (62,341).—A memorandum of satisfaction in full on September 17th, 1909, of mortgage dated December 21st, 1900, securing £800,000, has been filed.

Cunnington & Harris, Ltd. (104,982).—Debenture dated October 1st, 1909, to secure £250, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Susannah L. Attrill, 29, Villiers Street, Strand, W.C.

Lepel Wireless Syndicate, Ltd. (101,881).—A memorandum of satisfaction in full, on October 18th, of a charge dated August 18th, 1909, securing £200, has been filed.

CITY NOTES.

Berlin Electricity Works.

The report for 1908-9 of the Berliner Elektricitätswerke, which have a practical monopoly of lighting and power supply in the German capital, states that many difficulties were encountered during the year. Political concern for a time assumed an acute character and accentuated the crisis in trade and industry, which caused consumers to be reserved in the use of current, whilst the decline in building operations produced by the dearness of money in recent years restricted the number of new connections. The introduction of the 8 o'clock closing hour for shops diminished the lighting requirements in business establishments, and the energy economising metallic-filament lamps also prejudiced the consumption of current, and in consequence of the control exercised over the drivers by the Grand Berlin Tramways Co., there was a reduction of 580,000 KW.-hours in the use of power for working the tramways. The town of Rixdorf has availed itself of its right to give notice, and proposed to take over on October 8th, 1911, the distributing network used for the supply of this Berlin suburb, together with the house connections, meters and accessories, by virtue of the terms of the contract. It was intended to counteract the deficiency by the connection of large establishments for which an advantageous tariff had been worked out on the basis of the number of hours of use, and by the extension of sales in the further environs of Berlin where the possibility of cheap power would be offered to the growing industries in those localities. The number of consumers increased from 22,244 in 1907-8, to 24,786 in 1908-9, the connections advanced by 17,104 KW., to 164,364 KW., and including the quantity used by the works themselves, the total useful sales rose from 155,115,135 KW.-hours, to 157,887,625 KW.-hours in 1908-9. As a consequence of the displacement of the conditions between the sale of current for lighting and power purposes, the average sale price realised experienced a slight advance from 15·97 pfennigs in 1907-8, to 15·98 pfennigs per KW.-hour last year. The accounts show the following figures for the two years:—

	1908-9.	1907-8.
Ordinary share capital	£2,205,000	£1,575,000
Preference shares (4½ per cent.)	1,000,000	1,000,000
Loan capital	2,422,900	2,446,150
Gross profits	829,000	727,800
Depreciation provision	901,200	167,800
Net profits	409,800	559,400
Profit share of Berlin Municipality	124,500	192,500
Dividend on ordinary shares of £1,575,000 ..	11 %	11 %
Dividend on ordinary shares of £630,000 ..	4 %	—

It should be explained that the gross profits for 1908-9 include the sum of £54,600 derived from interest, but nothing was obtained from this source in the preceding year; and that including taxes the total payment to the city of Berlin amounts to £240,400 for the past year. Since July 1st additional connections representing 5,170 KW. have been made, and applications for a further 2,938 KW. were on hand on October 1st. The increasing consumption of current in the first three months of the new financial year, particularly for power purposes, is stated to indicate that with the disappearance of a number of disturbing factors, trade and industry have again become more actively employed, and a further favourable development of the company's business is therefore expected to take place in the present year.

Official Announcement re Companies.

The following are to be struck off the register in three months, unless cause is shown to the contrary:—

Adelaide Electric Tramways, Ltd.
Automatic Electric Co., Ltd.
Bettwsycoed Electric Lighting Co., Ltd.
Burmah Electric Works Syndicate, Ltd.
Cleminson Electric Lamp Attachment, Ltd.
Diamond Electric Lamp, Ltd.
Desrumaux's Automatic Water Softener and Purifier, Ltd.
Electric Laundry Co., Ltd.
Electric Royalties Syndicate, Ltd.
Electrical and Hardware Co., Ltd.
Electrical Bleaching Co. (1904), Ltd.
Electromotion Corporation, Ltd.
Expansion Turbine Syndicate, Ltd.
Hampstead Electric Supply Co., Ltd.
Helicoid Locknut Patents (Parent) Co., Ltd.
Hydro-Kinetic Engineering Syndicate, Ltd.
Ilford Accumulators, Ltd.
Imperial Engineering Supplies Co., Ltd.
Manchester and Liverpool Electrical Railway Syndicate, Ltd.
Medical Battery Co., Ltd. (Registered September 27th, 1989).
Midland Electrical and General Engineering Co., Ltd.
Motor Traction Co., Ltd.
Ozone Processes, Ltd.
Perth Electric Lighting Co., Ltd.
Pioneer Electric Light and Power Co. of China, Ltd.
River Po Electric and Power Syndicate, Ltd.
S. M. Van Hinden Electrical Co., Ltd.
South American Traction Co., Ltd.
Tavistock and District Electric Supply Co., Ltd.
Willoughby Destructor Syndicate, Ltd.
Wynne's Electric Closed Tube Tramways, Ltd.

Prospectuses.—*Alor Pongsu Rubber Estate, Ltd.*—This week 25,000 shares of £1 each are being offered for subscription at par.

Java Amalgamated Rubber Estates, Ltd.—This company has been offering 123,000 shares of £1 each for subscription at par.

Lendu Rubber Co., Ltd.—An issue of 45,000 shares of £1 each have been offered.

Rubber Estates of Bentota, Ltd.—28,500 shares of £1 each have been offered at par.

Stock Exchange Notices.—The Committee have appointed a special settling-day as under:—

November 17th.—Chiswick Electricity Supply Corporation.—£80,000 4½ per cent. first mortgage debenture stock.

Applications have been made to the Committee to allow the following securities to be quoted in the Official List:—

London United Tramways.—Further issue of £318,930 4 per cent. first mortgage debenture stock.

France.—La Compagnie Générale Electrique, of Nancy, is declaring a dividend of 60 fr. per share for the last financial year.

Western Telegraph Co., Ltd.

The seventy-second ordinary general meeting was held on Wednesday at Electra House, Finsbury Pavement, Sir J. Wolfe Barry, K.C.B., presiding.

In moving the adoption of the report (see Electrical Review, November 5th, page 746), the Chairman said that although there was a slight diminution in the message receipts and an increase in the working expenses and cost of the maintenance of the cables, he thought they would derive satisfaction from the report and statement of accounts. The message earnings showed a decrease of £1,567 compared with those of the corresponding period of 1908. The reduction in the tariff between Europe and the West Coast of South America, which was made on May 1st last, cost the company rather more than this sum, but they were compensated to some extent by increased traffic revenue from other countries. Rents, interest on investments and on money on deposit, &c., were more by £5,477, making a net increase in revenue from all sources of £3,893. The general expenses in London exceeded those of the half-year ended June, 1908, by £194. The expenses at the stations were more by £4,173. The increases occurred in salaries and wages due to annual promotions and additional staff. Pensions and expenses of training staff were slightly higher; foreign and other agencies, which had been more active in consequence of some important negotiations which had had to be carried on, had cost them more; rent and taxes due to new offices at Rio de Janeiro, repairs to buildings in consequence of structural alterations to the new offices just mentioned, postage and petty disbursements had also somewhat increased their expenses; also, he was sorry to say, medical expenses had increased, due to exceptionally heavy charges for medical attendance on account of a regrettable increase of illness amongst the staff during the half-year. Subscriptions to Consular chapels, &c., and legal expenses were also slightly higher. On the other hand, decreases were shown in the following items:—Travelling, repairs and renewals of furniture. A largely increased expenditure, amounting to £15,651 net, occurred in connection with the maintenance of cables. Considerably more cable had been used this half-year, costing over £18,000 during repairs, principally in their oldest main line section. A quarterly interim dividend, amounting to £31,189 10s. had been paid, £90,000 transferred to the general reserve fund, £5,000 to the maintenance ships' reserve fund, £10,000 to the marine insurance fund, and £10,000 to the land and buildings depreciation fund. The directors now recommended the declaration of a final dividend of 3s. per share, making, with the interim dividends, a total dividend of 6 per cent. for the year, also the payment of a bonus of 2s. per share, both free of income-tax, which, together, would amount to £51,982, leaving a balance of £6,463 14s. 10d. to be carried forward. At the last meeting the shareholders were informed that negotiations were proceeding with the Brazilian and Argentine Governments with regard to improved telegraphic communications, and he was now glad to state that a satisfactory arrangement with the Argentine Government had been concluded, under which a new and direct cable would be laid by the company from Buenos Ayres to the Island of Ascension, where it would join the existing main line route to Europe. The cable was now being manufactured, and they hoped it would be laid and in working order during next year. Their main line cables to Brazil, as they were aware, had been laid for a considerable number of years, and in view of the age of these cables the directors thought it right to propose to the Brazilian Government to also strengthen the means of telegraphic communication by laying a direct cable from Ascension to Rio de Janeiro. Those negotiations were in progress, but were not yet concluded. It was evident that the offer which they had made was one which must be of the greatest advantage to Brazil, by putting the capital city of that great country in the same position as would be shortly secured to Buenos Ayres, the capital of Argentina. He regretted to report that Lord Richard H. Browne resigned his seat on the board in consequence of failing health, but was glad to say that they had been able to fill the vacancy by securing the services of Mr. John George Griffiths, who had been connected with this and the associated companies for a great many years and had an intimate personal knowledge of South America.

Sir John Denison-Pender, K.C.M.G., seconded the resolution.

Mr. J. Stacey Reeves asked whether the time had not come when it was unnecessary to continue piling up the reserve fund, which now amounted to more than half the capital of the company.

The Chairman said they must not ask them to diminish the reserve fund, because the commitments they were now taking in connection with Brazil and Argentina would draw very considerably upon the fund. The great *desideratum* in all cable companies was stability, so that they could undertake work on renewals and extensions without affecting a stable dividend. That they had been able to do for many years past, and he hoped they would be able to continue that policy for many years to come.

The report was then adopted.

Norwich Electric Tramways Co.

The annual meeting of this company was held in London on Friday, Mr. Francis Fitzgerald presiding.

The directors' report for the year ended June 30th last stated that the balance of profit derived from the working of the tramways, as shown by the revenue account, was £7,772, plus £156 interest and transfer fees received, bringing the gross profit for the year up to £7,928, or, including the balance brought forward from the previous year, to £7,958. Deducting from this amount the sum of £2,640, 4 per cent. interest on the company's mortgage bonds for the year, there remains a sum of £5,318 to be dealt with. The directors recommend that £500 be placed to reserve fund account, that a dividend of 1¾ per cent., amounting to £4,620, less income-tax, be paid on the shares of the company, for the year ended June 30th, 1909, and that the balance of £198 be carried forward. Comparing the accounts with those for the year ended June 30th, 1908, the revenue has decreased by £621, and the expenses have decreased by £2,238, showing an increase of £1,617 in the profits for the year. The directors call attention, however, to the fact that the profits have been arrived at after charging to revenue the following extraordinary expense for arbitration law costs, £909. The permanent way, rolling stock, and power station have been maintained in an efficient condition out of revenue. The number of passengers carried was 7,371,524, an increase of 181,163 on the previous year, and the number of car-miles run was 1,002,258, as against 1,049,175. The earnings per car-mile were 7·76d., and the expenses 5·72d., while the earnings per passenger were 1·02267d.

The Chairman said that since the accounts had been made up there had been an improvment in the gross income of £537, notwithstanding the fact that the returns on August Bank-holiday suffered the considerable diminution of £240. The visit of the King this week had not only rejoiced the hearts of the citizens of Norwich, but it had proved a rich source of revenue to the company, and he wished such visits were more frequent.

The report was adopted.

Eastern Telegraph Co., Ltd.

The meeting of the above company was held on Wednesday at Electra House, Finsbury Pavement, Sir J. Wolfe Barry, K.C.B., in the chair.

The Chairman, in moving the adoption of the report (see Electrical Review, November 5th, page 747), said that the gross revenue for the half-year under review amounted in round figures to £592,600, against, for the corresponding half-year of 1908, £568,400, or an increase of £24,200. The receipts from messages exchanged with South Africa continued to improve, and the principal increase in the revenue this half-year was from that source. Various other branches of traffic showed small increases; but there was a further decline of about £4,000 in the receipts from traffic with Egypt, to which he referred at the last meeting. The message receipts as a whole, however, showed a satisfactory increase, and he was glad to be able to state that their general revenue continued up to the present date to be fairly well maintained. During the half-year they received £6,400 more in respect of interest and dividends on reserve fund investments, but, on the other hand, interest on cash at bankers on deposit yielded £3,200 less, leaving a net increase in respect of interest of £3,200. With regard to the expenditure side of the revenue account, the total expenses amounted in round figures to £278,900, against, for the half-year to June, 1908, £261,100, or an increase of £17,800. He was pleased to state that the ordinary expenses were less by £2,000 than they were for the half-year to June, 1908, but the expenses attending maintenance of cables were unusually heavy, the total expenditure under this head, including the depreciation of spare cable, being £70,500, against £51,200 for the corresponding period of 1908. This increase was largely due to their having expended a much larger quantity of cable on the repairs of various sections of their line; this item alone accounted for £11,000 of the increase. The comparison of the expenditure under this abstract was further adversely affected in consequence of the amount received from foreign Governments and other telegraph companies for the charter of their repairing ships, being considerably less during this half-year than it was in the corresponding period of last year. During the half-year they had renewed a further 63 knots of the Aden-Bombay No. 1 cable, which was originally laid in 1870, the cost of this partial renewal amounting to £8,337 being charged, as usual, against the general reserve fund. The operation of gradually renewing this cable had extended over several half-years, and up to the date of the accounts they had renewed about 1,570 knots, at a total cost of about £260,000, the whole of which had been charged to this fund. Since the accounts were made up they had laid in a further 100 knots, leaving about 220 knots still to be renewed. The type of cable employed in the renewal of this section would give a greater carrying capacity than that of the cable which was originally laid in the year 1870. It was to meet such expenditure that the general reserve fund was provided, and when operations of this kind became necessary the importance of building up this fund became more apparent. The net result of the half-year's working was that they had £4,300 more available for distribution than in the corresponding period of 1908, and, as it was not proposed on this occasion to further augment the maintenance ships' fund, they were able to make a contribution of £10,000 more to the general reserve fund than was transferred to the fund for the corresponding half-year of 1908.

Sir J. Denison-Pender, K.C.M.G., seconded the resolution, and the report was adopted.

Allgemeine Elektricitäts Gesellschaft.—The Berlin correspondent of the *Times* states that this company has declared a dividend for the business year 1908 of 13 per cent., as against 12 per cent. in the previous year. The net profits amount to £815,000, as against £795,000 for the previous year.

Edison & Swan United Electric Light Co., Ltd.

The twenty-sixth ordinary general meeting of the above company was held at Winchester House, E.C., on November 4th, under the chairmanship of Mr. Henry Wolfenden.

In moving the adoption of the report (see Electrical Review, October 29th, page 706), the Chairman said they were again faced with a large decrease in their profits, caused by a decline in the price of the carbon lamps, which were the principal lamps they had been dealing in so far. This decline was not the result of any falling off in their quality, which had been maintained at its usual high standard of excellence, nor was the shrinkage the result of any material falling off in the turnover. Their total business in the year under review in all classes of goods taken together showed a reduction of only 1·6 per cent. in value, as compared with the previous year, and having regard to the depression in trade generally, and in the electrical branch in particular, he ventured to think that was not very unsatisfactory. On analysis, however, they found that the carbon lamp sales showed a decline of 6 per cent. in volume, but the value was reduced by 17½ per cent. It was here that they got the clue to the shrinkage of profits, viz, the lower selling price in carbon lamps without a corresponding reduction in the cost of manufacture or distribution. The smaller sales and lower prices were the result of the diminished demand for this class of lamp owing to the change to the metal-filament lamp, and they had been actively engaged in the year in pushing forward this new type of manufacture. There had been expended on capital during the year ending June 30th, a sum of £19,873, almost entirely on account of additions to buildings and plant in connection with the manufacture of metal-filament lamps. They had reduced the production of carbon lamps during the year, but they still thought there would always be a field for their use. On the other hand, they had materially increased the production of metal lamps although the accounts under review did not have the full benefit of that increase. They were turning out at the present time a large number of these lamps in a complete range of candle-powers and voltages, and confidently hoped to have a substantial increase month by month. The quality continued to be satisfactory, and was quite equal to anything on the market. The inauguration and development of this metal lamp manufacture had presented many serious difficulties, but he thought they might claim now to have succeeded in surmounting these difficulties, and their best thanks were due to the loyal and able staff at the factory for the zeal, energy, ability and courage they had displayed over a long and trying time both for them and for himself. Moreover, this new business had been established cheaply and economically. The experimental work had been carried out at their own factory, and the cost charged to revenue. In fact, the new business had been created without expenditure on capital account, except so far as was represented by tangible assets, such as buildings and plant. With reference to the cost of manufacturing carbon lamps, it was impossible to reduce it, for it was already at a minimum. They had, however, felt for some time past, that the question of the sale and distribution of their goods was one which called for careful consideration with a view to obtaining greater economy without impairing efficiency. Now that the strain in connection with the metal lamp was to some extent relaxed, this other matter was receiving, and would continue to receive, their close attention, and he might say that following the changes made in their selling department at the head office about the end of the financial year, they, in September last, appointed a commercial manager, who, under the direction of the board, was now devoting his attention to this important question with a view to securing greater economy and better results by the adoption of improved methods of selling and the reduction of costs. Steps were being taken with this end in view, but, of course, in a matter of such importance to the business, each step needed to be carefully considered beforehand. In this reduction, the board intended to participate, notwithstanding that in times such as they had to deal with, the work of the directors was more onerous. Turning to the accounts, the chairman referred to the sum allocated for depreciation, and said that it had been reduced, and for depreciation on property stood at 2 per cent. In this connection, regard must be had to the fact that they had written down their property in the last eight years by over £26,000, and of the £78,500 now standing to the debit of that account, nearly £16,000 had been expended on new buildings in the last four years. In like manner, the appropriation for depreciation on plant and tools had been reduced, but he would point out that nearly £46,000 had been written off this item in the last eight years, and of the £77,000 at which they stood in the balance-sheet, nearly £30,000 represented new plant in last five years. In the balance-sheet the material alteration was that the investments were considerably down owing to the sale of securities to provide the necessary additions for the manufacture of the metal-filament lamps. Sundry creditors were up for the same reason. Investments were now set out for the first time at cost as a reserve fund, and about £1,400 had been applied to that account, which was derived from the profit realised on the sale of securities, together with a sum which had been previously reserved for another purpose, and which, on adjustment, was found to be in excess of the actual requirements. The market value of the investments to-day was £700 below the amount at which they stood in the balance-sheet. Stocks and work in progress were up by £4,300; the figures being £176,700 this year, against £172,400 last year. This increase was more than represented by the stock of metal-filament lamps, and the carbon lamp stock was practically stationary on the year. The figure included also the stocks of raw materials and stores at the various works and all work in progress. The net result of the year's working, was that after providing £15,701 for debenture interest and £10,713 for the reserve fund for depreciation and bad debts, they had a small sum of £421 to carry forward, which made the total carry forward £10,027. They considered that in connection with the affairs of the company much work had been done and progress made during the year, and although the effect was not reflected in the accounts under review, it would bear good fruit in the future.

Mr. E. B. Ellice Clerk seconded the motion, and the report was agreed to unanimously without discussion.

Eastern Extension, Australasia and China Telegraph Co., Ltd.

The half-yearly meeting was held at Electra House, E.C., on Tuesday, under the chairmanship of Sir John Wolfe Barry.

In moving the adoption of the report (see Electrical Review, November 5th, page 745), the Chairman said that the gross revenue was practically the same as in the corresponding period of 1908, the actual figures being £290,931 this year, against £290,295 last year. It was only right, however, to mention that the traffic receipts again showed a falling off amounting to, roundly, £8,000, due to the commercial depression that had been so severely felt in the Far East during the last few years. Fortunately they had been favourably affected by the dollar exchange conditions prevailing in China during the past half-year, and the increased revenue from this source had not only enabled them to wipe out the traffic loss, but to show a few hundred pounds increase for the past half-year. During the last month or two, there had been a little improvement in most of the traffics, which encouraged the hope that the depression was beginning to pass away. The working and other expenses amounted, in round numbers, to £157,000, against £151,000 for the corresponding period of 1908, showing an increase of £6,000. Of this, £3,300 appeared under the heading of "salaries and wages," and the balance was accounted for by their having had fewer ships' charters this year than in the corresponding period of last year, which made the expenses attending the maintenance of cables appear greater than they were last year, although in reality the maintenance expenditure was less by over £3,000. With regard to the increase of £3,300 in salaries, £1,300 of this was due to their having had to provide additional staff for the Java-Cocos cable laid last year, which had materially added to the efficiency of the service; £1,400 represented the amount of compensation granted to some of the senior staff whose engagements had to be terminated when the Tasmanian cables were recently closed, and the balance of £600 was due to automatic increases of salary. The net profit for the half-year was, roundly, £116,000, and after adding £18,000 brought forward from the previous half-year, there remained an available balance of £134,000. The usual quarterly interim dividends of 2s. 6d. per share, or at the rate of 5 per cent. per annum, had been paid for the past half-year, leaving a balance of £58,844 to be carried forward. When he last addressed them he explained that in consequence of the Australian Federal Government having laid and opened cables of their own between Victoria and Tasmania, when the company's exclusive concession expired on April 30th last, they had been obliged to close their Georgetown and Flinders stations, and intended, when a suitable opportunity occurred, to pick up the cables between Victoria and Tasmania and utilise them elsewhere. For this purpose their largest ship, the ss. *Patrol*, stationed at Singapore, was necessary, and as they had so far had no other cable work for her to carry out in Australian waters, the Tasmanian cables had not yet been picked up. Seeing, however, that the capital account had for some little time past been considerably over-expended, and that the original cost of the Tasmanian cable communication (£70,000) was included in the capital expenditure, it was considered advisable to write down the capital account by this amount and debit the general reserve fund with it. This had accordingly been done, and when the cables had been picked up and overhauled, the account could be finally adjusted by crediting the reserve fund with the estimated value of the old cables after deducting the expense of picking them up and transporting them to Singapore.

The Marquess of Tweeddale seconded the motion.

Mr. Reich pointed out that the expenses were constantly growing. Their revenue for the year would be about £230,000, and the dividend of 7 per cent. took £210,000, so that there was not much margin. He suggested also that instead of stating the investments at cost and setting aside £120,000 for investment fluctuations, it would be better to set out the investments at the market price on the day of making up the accounts.

The Chairman said it was true the expenses had grown, as the public expected so much accommodation, whilst the revenue had not been so great; but as he had said, this had been due almost entirely to stagnation of trade in the Far East, and other enterprises connected with that part of the world had suffered in like proportion. He did not want to prophesy further than he could see, but he did not think they need have any great alarm but that the dividend would be maintained, at all events for the present. The matter of the investment depreciation had been discussed, and it was felt better to set aside the £120,000 for depreciation, and to state the investments at what they actually cost the company. As a matter of fact, on the date of making up the accounts the depreciation was £137,000, which only meant a difference of £17,000 on one and a third million pounds of investments.

The report was then adopted, and a vote of thanks accorded the board and the staff.

MARKET QUOTATIONS.

Wednesday, November 10th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	,,	22/-	..
a ,, Oxalic	,,	28/-	..
a ,, Sulphuric	,,	5/6	..
a Ammoniac, Sal	,,	42/-	..
a Ammonia, Muriate (crystal)	per ton	£29	..
a ,, ,,	,,	£30	..
a Bleaching powder	,,	£5 10	..
a Bisulphide of Carbon	,,	£18	..
a Borax	,,	£16	..
g Ferro-Silicon (50 %)	,,	£11	..
h Copper Sulphate	,,	£18 10	..
a Lead, Nitrate	,,	£26 10	..
a ,, White Sugar	,,	£23 10	..
a ,, Peroxide	,,	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (75/80 %)	per ton	£20	..
a ,, Chlorate	per lb.	3½d.	..
a ,, Perchlorate	,,	8½d.	..
a Potassium, Cyanide	,,	7d.	..
a Shellac	per cwt.	75/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	,,	£6 10	..
,, Recovered	,,	£5 10	..
a ,, Lump	,,	£5	..
a Soda, Caustic (white 70 %)	,,	£11	5s. inc.
a ,, Chlorate	per lb.	3½d.	..
a ,, Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	3d.	..
a ,, Cyanide (basis 100 %)	,,	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£75	..
b ,, Wire, in ton lots	,,	£112	..
b ,, Sheet, in ton lots	,,	£120	..
p Babbitt's metal ingots	,,	£50 to £136	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7¼d.	..
c ,, Tube (brazed)	,,	8¾d.	..
c ,, ,, (solid drawn)	,,	7¼d.	..
c ,, Wire, basis	,,	6¾d.	..
c Copper Tubes (brazed)	,,	8¾d.	..
c ,, ,, (solid drawn	,,	8¾d.	..
g ,, Bars (best selected)	per ton	£72	£2 inc.
g ,, Sheet	,,	£72	£2 inc.
g ,, Rod	,,	£72	£2 inc.
e ,, (Electrolytic) Bars	,,	£60 10	..
e ,, ,, Sheets	,,	£77	..
e ,, ,, Rod	,,	£65 10	..
e ,, ,, H.C. Wire	per lb.	7¾d.	..
f Ebonite Rod	,,	3/3	..
f ,, Sheet	,,	3/-	..
n German Silver Wire	,,	1/6	..
b Gutta-percha, fine	,,	5/6 to 6/6	..
b India-rubber, Para fine	,,	3/3	9d. dec.
j Iron Pig (Cleveland warrants)	per ton	50/10	1d. dec.
l ,, Wire, galv. No. 8, P.O. qual.	,,	£14	..
g Lead, English Ingot	,,	£13 5 to £13 7 6	dec.
m Manganin Wire No. 28	per lb.	6/6	..
e Mercury	per bot.	£9 17 6	inc.
d Mica (in original cases) small	per lb.	6d. to 1s.	..
d ,, ,, medium	,,	2/6 to 4/-	..
d ,, ,, large	,,	4/6 to 8/6	..
p Phosphor Bronze, plain castings	,,	1/- to 1/1½	..
p ,, ,, rolled bars & rods	,,	1/1½ to 1/3	..
p ,, ,, rolled strip & sheet	,,	1/2½ to 1/6	..
o Platinum	per oz.	120/-	variable.
c Silicium Bronze Wire	per lb.	9d.	..
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	,,	£136 to £137	10/- inc.
n ,, Wire, Nos. 1 to 16	per lb.	1/9	..
p White Anti-friction Metals:—			
"White Ant" brand	per ton	£35 to £60	..
k Zinc, Sh't (Vieille Montagne bnd.)	,,	£27	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
j Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p The Phosphor Bronze Co., Ltd.
r W. F. Dennis & Co.

Amazon Telegraph Co., Ltd.—The directors' report for the year ended June 30th last shows a gross revenue of £77,365, and total working expenses £48,691, plus £26,984 for debenture interest and sinking funds, leaving £1,690 to the credit of the revenue account for the year, which reduces the debit balance to £49,386. The Brazilian Government has granted an extension of the present concession for 20 years from 1925 to 1945, together with an extension of the payment of the present subvention of £17,125 per annum for 20 years from 1915 to 1935, in consideration of the company duplicating its main cables. It is proposed to issue new debentures in order to provide for the cost of the duplication and for the repayment of the debentures now outstanding, and an extraordinary general meeting will be held after the ordinary general meeting on November 16th for the purpose of sanctioning £300,000 5 per cent. debentures and for making certain alterations in the articles of association, providing, *inter alia*, that whenever the reserve fund shall amount to less than £250,000 no dividend shall be paid in any year at a higher rate than 5 per cent. per annum.

STOCKS AND SHARES.

Tuesday Afternoon.

Over the Stock Exchange markets broods a general air of subdued melancholy, enlivened only by fitful gleams of cheerfulness. Money is dear, and not one of the departments in the House escapes from the effects of the burden. Brokers and dealers—ever prone to exaggerate—take a gloomy view of business prospects for the immediate future, but console themselves and each other with the reflection that all shall be well when the new year brings cheaper money and a lower Bank Rate. Some express a pious hope that the 5 per cent. minimum may be reduced before Christmas.

Home Railway stocks are all sliding back into the old rut of depression with which they are so familiar from long experience. The end of the half-year being in sight, prices should benefit from consideration of dividends to come, but not a ray of cold comfort do they derive from this. City & South London and Metropolitans are lower; so are Districts, and the seller of any Home Railway stock throughout the list finds that he is regarded as a menace instead of being welcomed as a friend. The Brighton Railway announces that its new electric service will start on the first of next month.

Here and there the prior-charge issues of the leading railway companies show an inclination to recede, but up to the present this factor has not affected the Debenture stocks of the electric traction lines, beyond a point fall in Baker Street & Waterloo, lowering the middle price to 98.

Electricity Supply descriptions are stagnant. Charing Cross and City "Lights" are each ⅛ lower. These two companies, with the County of London, are doing a little in the way of affording publicity to the attractions of electric radiators, and, considering the fine field that still exists for this form of enterprise, it is a little curious that more vigour is not displayed in bringing the matter to the notice of possible consumers. With almost every City office using electric current for lighting, and with the eagerness that is apparent amongst City men for details of radiator work, it ought not to be a difficult matter to get the articles installed into thousands of offices which are now served by other methods of heating.

The Canadian-Mexican group is steady, without sensational matter of interest. Mexico Trams reacted ¼, and at 89 Rio Trams are 1 lower. British Columbia stocks are downgrading, the Deferred showing most loss with a drop of 3, followed by a fall of 1½ in the Preferred and 1 in the Preference; but the First Debentures are 2 higher. Profit-taking after the long rise, joined with the nervousness engendered by dear money, is assigned as the cause of the movement; but perhaps proprietors of these issues have been tempted to sell in order to embark in some of the newer ventures lately emanating from the Dominion.

Brisbane Electric Tramways Investment Ordinary has hardened to 6⅞, and the 5 per cent. Preference to a trifle over 5. The 4½ per cent. Debenture stands at 100½, carrying nearly five months' interest. Winnipeg Electric Railway 4½ per cent. Debenture stock has been changing hands at about 103½. Anglo-Argentine Trams 4 per cent. Debenture eased off a trifle, and Metropolitan Electric Trams 4½ per cent. Debenture declined to 95. British Electric Tractions are being picked up, with the result that the Preference shares have risen $\frac{3}{16}$, and the First Debenture at 84½ is the fraction to the good.

West India and Panama Telegraphs have been favoured on the good dividends declared by the company, and all four classes of securities have advanced. The Eastern group remains extremely quiet, the dividends and reports not affecting the quotations in any way. Anglo-Americans have weakened, the Deferred being ⅝ down, and the Preferred ¼. The Amazon Telegraph Company has done badly in its past year, making a profit of no more than £1,700, which is applied to the debit balance brought in, lowering that item to £49,400. Marconis have not recovered from their decline of last week. Telephone stocks and shares exhibit trifling changes, of which falls of ¼ in Chili Telephones and of ½ in National Telephone Deferred are the only noticeable examples.

The most satisfactory feature amongst miscellaneous varieties is a further recovery in British Westinghouse 4 per cent. Debenture, which raised the price 4½ points to 50. Even the Preference shares are ⅛ better at 10s. middle. The market being so limited, these movements are of course more or less the outcome of quite retail demand, but it is so long since Westinghouse issues have improved, until this last fortnight, that the rise certainly deserves a paragraph to itself.

Babcock and Wilcox shares are strong, and show 2s. 6d. gain at 4¼. Edison & Swan "A" have dropped to a nominal price of a few shillings, and General Electric Preference show ¼ fall.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1906.	1906.	1907.	1908.	Closing Quotations Nov. 2nd.	Closing Quotations Nov. 9th.	Business done week ended Nov. 9th, 1909. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	8 — 8½	8 — 8½	..	..	..	Nil.
186,700	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	5 %	5 %	5 %	5 %	96 — 99	96 — 99	..	..	..	5 1 0
$121,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7½%	8 %	8 %	8 %	144 —146	141 —146	..	..	..	5 9 7
$53,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	96 — 98	96 — 98	..	..	..	4 1 8
558,460	Anglo-American Telegraph	Stock	3½%	3½%	3½%	£3 4s.	61 — 63	61 — 63	61	..	..	5 8 2
3,220,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	101½—102½	101½—102½	102½	101⅜	— ⅛	5 17 1
3,220,770	Do. do. do. Deferred	Stock	⅜%	1⅜%	1 %	8/-	2⅛— 2⅞	2⅛— 2⅞	2⅛	2⅛	+ ⅛	1 15 7
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	101 —103	101 —103	..	..	..	4 17 1
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	8 %	8 — 8⅜	7⅞ — 8⅛	7⅞	..	— ⅛	4 18 6
2,431,350	Commercial Cable, Sling. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	87½— 88½	87½ — 89⅛	88	..	..	4 9 5
16,000	Cuba Telegraph	10	5 %	5 %	6 %	6 %	8⅝— 9⅛	8⅝ — 9⅛	8⅛	..	..	6 9 9
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	17 — 18	17 — 18	..	..	..	5 11 1
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	3 — 3½	3 — 3½	..	..	..	5 14 8
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8 — 8½	8 — 8½	..	..	..	6 5 0
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100½—102½	100½—102½	..	..	..	2 3 11
30,710	Direct United States Cable	20	4½%	4½%	4½%	4½%	13 — 13½	13 — 13½	13⅜	..	..	6 4 7
43,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,900, R.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
4,000,000	Eastern Telegraph, Ord. Stock..	Stock	7 %	7 %	7 %	7 %	126 —129	126 —129	128	126½	..	5 8 6
2,000,000	Do. 8½ % Pref. Stock..	100	8½%	8½%	8½%	8½%	83½— 85½	83½— 85½	85	83½	..	4 1 10
1,996,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	102½—104½	102 —104	102	..	— ½	3 16 11
800,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	7 %	11⅝— 12⅛	11⅝— 12⅛	12	11⅝	..	5 14 8
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	102 —104	102 —104	103½	102½	..	3 16 11
200,000	East. & S. Afric. Tel., 4 % Mt Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 —102	100 —102	99	..	..	3 18 5
181,197	Globe Telegraph and Trust	10	5½%	5½%	5½%	5½%	10⅜— 10⅝	10⅜— 10⅝	10 7/16	..	..	5 8 8
181,127	Do. do. 6 % Pref...	10	6 %	6 %	6 %	6 %	13½— 14	13½— 14	13⅝	13⅜	..	4 5 9
150,000	Great Northern Telegraph, of Copenhagen.. ..	20	24%	20 %	20 %	18 %	28½— 29½	28½ — 29½	..	..	..	7 0 0
10,000	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,900, Red.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 8
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	13 %	51 — 53	51 — 53	..	..	..	7 1 2
$41,380,400	Mackay Companies Common	$100	2 %	3½%	4 %	4 %	93⅜— 95	93 — 95	..	..	..	4 4 3
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	77 — 79	77 — 79	..	..	..	5 1 3
394,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	⅜— ⅝	⅜— ⅝	12/-	..	..	N l
72,680	Monte Video Telephone Co., Ltd. Ord.	1	5 %	6 %	6 %	6 %	⅜— ⅝	⅜— ⅝	17/6	..	..	6 8 0
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	⅜— ⅝	⅜— ⅝	17/6	..	..	5 6 8
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	107 —108½	107 —108½	107½	107½	..	5 10 7
3,725,000	Do. do. Def. Stock	100	5 %	5 %	6 %	6 %	120 —122	119½—121½	120½	119¾	— ⅜	4 18 9
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10½— 11	10½— 11	10¾	..	..	5 9 1
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	6 %	10½— 10⅞	10½— 10⅞	10⅜	..	..	5 10 4
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅜— 5⅝	5⅜— 5⅝	..	..	..	4 8 11
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	98 —100	98 —100	..	..	..	3 10 0
1,988,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	100⅜	..	..	3 18 5
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	7 %	8 %	8 %	1⅜— 1½	1⅜— 1½	27/6	..	..	5 5 9
50,000	Do. do. do. 6 % Cum. Pref... ..	1	6 %	6 %	6 %	6 %	1 7/16— 1 9/16	1 7/16— 1 9/16	..	..	..	4 14 9
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	86½— 88½	86½— 88½	..	..	..	4 10 5
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
11,889	Reuter's	8	5 %	5 %	5 %	5 %	7⅝— 8⅛	7⅝— 8⅛	8	..	..	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	100½—102½	100½—102½	..	..	..	4 7 10
3,042	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	129 —132	129 —132	..	..	..	4 10 11
120,000	United River Plate Telephone	5	8 %	8 %	8 %	8 %	6⅞— 7⅛	6 15/16— 7 1/16	7⅛	6 15/16	+ 1/16	5 10 1
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5⅞— 6 1/16	5 15/16— 6 1/16	5⅞	..	..	3 16 4
30,008	W. Coast of America, 1 to 30,000 & 53,001 to 53,008	2½	Nil	2½%	2½%	2½%	1⅝— 1⅞	1⅝— 1⅞	..	..	..	3 18 5
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	5 0 0
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980.. ..	10	7 %	7 %	7 %	7 %	13½— 14	13½— 14	13⅝	13½	..	
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	103 —105	103 —105	103⅜	..	..	3 16
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	1/16— 1/8	1/16— 1/8	17/6	15/-	+ 1/16	Nil
84,558	Do. do. 6 % Cum. 1st Pref.	10	5 %	6 %	6 %	6 %	8½— 9½	8½— 9⅝	9 5/16	9 1/16	+ ⅛	6 8 0
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	£2 6	15 %	8⅝— 9⅜	8⅝— 9⅝	9⅛	9⅛	+ ⅛	15 7 8
80,000	Do. do. 5 % Debs., Nos. 1 to 1,800	100	5 %	5 %	5 %	5 %	101½—103½	102 —104	..	..	+ ⅛	4 16 2

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

640,000	Anglo-Argentine Trams, 5 % Cum. 1st Pref., 1 to 640,000	5	..	..	..	..	4⅛— 4⅜	4⅛— 4⅜	93/9	90/7½	..	5 2 4
500,000	Do. 5 % 2nd Pref., 800,001 to 1,800,000	5	..	..	..	..	4⅛— 4⅜	4⅛— 4⅜	..	..	..	5 6
978,280	Do. 4 % Deb. Stock	..	..	..	..	4 %	91 —92½	90¼— 92	91½	90½	— ⅜	4 7 0
882,887	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	102 —105	102 —105	..	..	..	4 15 8
580,000	Babcock & Wilcox, 1 to 580,000..	1	20 %	20 %	20 %	20 %	4⅛— 4⅜	4⅛— 4⅜	95/-	90/7½	+ ⅛	4 3 8
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1 15/16— 1 1/16	1 15/16— 1 1/16	..	..	..	3 19 2
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	7 %	1⅜— 1½	1⅜— 1½	..	..	..	37 6 8
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	1⅞— 2⅛	1⅞— 2⅛	..	..	..	15 1 4
40,100	Do. do. "A" 6 % Cum. Pref. ..	5	6 %	6 %	6 %	6 %	3⅜— 3⅝	3⅜— 3⅝	..	..	..	7 10 11
12,897	Do. do. 4 % Funding Certs. ..	5	4 %	4 %	4 %	4 %	2⅜— 3½	2⅜— 3½	..	..	..	6 14 3
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	..	5½%	5½%	5½%	96 — 99	96 — 99	97½	..	..	5 14 7
500,000	British Columbia E. Rail Def. Ord. Stock ..	100	6 %	6 %	8 %	8 %	150 —155	147 —152	151	147½	—3	5 5 3
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	5 %	6 %	123 —128	122 —126	123	122	—1½	4 15 3
400,000	Do. 5 % Cum. Perp. Pref. Stock ..	100	5 %	5 %	5 %	5 %	109 —112	108 —111	111½	109½	—1	4 10 1
233,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	100 —102	102 —104	102	..	+2	4 6 7
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	102 —105	102 —105	103½	103	..	4 5 9
138,301	British Electric Traction	10	3 %	Nil	Nil	Nil	⅜— 1	⅜— 1	..	..	..	Nil
161,437	Do. do. 6 % Cum. Pref.	10	6 %	6 %	8 %	1½%	2⅛— 2⅜	2⅛— 2⅜	52/6	48/1½	+ 1/16	5 13 4
1,473,558	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	82½— 85½	83 — 86	85½	84½	+ ½	5 16 3
528,936	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	58 — 62	58 — 62	59½	59	..	7 5 2
100,000	British Insulated and Helsby Cables	5	8 %	10 %	10 %	10 %	7⅛— 7⅜	7 — 7⅛	7 3/16	7⅛	— 1/16	6 13 4
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6⅛— 6⅜	6⅛— 6⅜	..	..	..	4 11 8
500,000	Do. do. 4½ % 1st Mort. Deb. Red..	100	4½%	4½%	4½%	4½%	103 —106	103 —106	105½	..	..	4 4 11
904,940	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	89 — 94	89 — 94	..	..	..	4 15 9
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	Nil	⅛— ⅜	⅜— ⅝	..	..	+ ⅛	Nil
1,616,858	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	44 — 47	48 — 52	48	..	+4½	7 13 10
50,000	Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	⅝— 11/16	⅝— 11/16	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,781 ..	2	2½%	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref. ..	2	6 %	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
125,000	Do. do. 4½ % Perp. Deb. Stock	Stock	4½%	4½%	4½%	4½%	41 — 46	41 — 46	..	..	..	9 15 8
125,000	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	27 — 31	27 — 31	..	..	..	14 10 2
127,610	Calcutta Trams, 1 to 127,610	5	8 %	8 %	6 %	4½%	4⅛— 5	4⅛— 5	93/9	..	..	4 10 0
45,304	Do. 5 % Cum. Pref., Nos. 1 to 39,880..	5	5 %	5 %	5 %	5 %	4⅛— 5	4⅛— 5	95/7½	..	..	5 0 0
850,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
85,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	15 %	10⅜— 10⅝	10⅜— 10⅝	10⅜	..	..	6 18 0
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5⅜— 5½	5⅜— 5½	5⅜	..	..	4 6 11
900,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	105 —107	105 —107	..	..	..	4 4 1
491,323	Cape E. Trams., 1 to 491,323	1	Nil	Nil	Nil	Nil	7/16— 9/16	7/16— 9/16	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	6 %	8 %	12 %	12½%	2 1/16— 2 3/16	2 1/16— 2 3/16	42/6	..	..	5 19 1
310,158	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	4 %	106 —109	106 —109	..	..	..	3 13 5
1,890,690	Central London Railway, Ord. Stock	Stock	4 %	4 %	3 %	3½%	60 — 62	60 — 62	61½	60½	..	5 4 10
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	85 — 87	85 — 87	..	..	..	4 14 2
554,655	Do. do. Def. do.	Stock	4 %	4 %	2 %	2½%	43 — 45	43 — 45	45	..	..	5 11 1
1,480,000	City and South London Railway	Stock	17½%	24½%	24½%	14½%	80 — 81	29½— 80½	31	30	— ½	4 18 4
85,000	Crompton & Co., Nos. 1 to 85,000	8	2½%	5 %	5 %	5 %	½— 1	½— 1	..	..	..	15 1 8
100,000	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	..	5 %	5 %	5 %	90 — 98	90 — 98	..	..	..	5 7 6

* Unless otherwise stated, all shares are fully paid. † A period of nine months. From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued.*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1905.	1906.	1907.	1908.	Closing Quotations Nov. 2nd.	Closing Quotations Nov. 9th.	Business done week ended Nov. 9th, 1909. Highest	Lowest	Rise + or Fall −	Present Yield per cent. £ s. d.
950,000	Dick, Kerr & Co., 1 to 950,000	1	10 %	10 %	10 %	10 %	1 — 1⅛	1 — 1⅛	..	..	..	8 17 9
805,000	Do. do. 6 % Cum. Pref., 1 to 805,000	1	6 %	6 %	6 %	6 %	1 — 1⅛	1 — 1⅛	..	..	..	5 6 8
271,080	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	12⅜— 13⅜	12⅜— 13⅜	..	..	..	4 7 3
99,261	Edison & Swan Utd., "A" shs., £8 pd., 1 to 99,261	5	4½%	4½%	2½%	1½%	⅜— ⅝	⅜— ⅝	4/-	3/6	— 1/16	34 5 8
17,139	Do. "A" shares, 01—017,139	5	4½%	4½%	2½%	2½%	1 — 1⅛	1 — 1⅛	..	..	..	8 6 8
307,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	68 — 73	68 — 73	..	..	..	5 9 7
67,730	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	82 — 85	82 — 85	..	..	..	5 13 4
119,100	Electric Construction, 1 to 119,100	2	Nil	Nil	Nil	Nil	⅞— 1	⅞— 1	..	..	..	Nil
31,890	Do. do. 7 % Cum. Pref., 1 to 31,890	2	7 %	7 %	7 %	7 %	1⅞— 1⅞	1⅞— 1⅞	22/6	..	..	9 13 1
35,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	5 %	8 — 8½	8 — 8½	..	..	— ½	5 17 8
200,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	4 %	83 — 87	83 — 87	..	..	..	4 12 0
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	½%	Nil	¾ — 1	¾ — 1	..	..	..	6 13 4
95,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	7 %	10½— 10¾	10½— 10¾	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103½	102 —103	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15%	15 %	15%	15 %	12½— 13½	12½— 13½	..	..	..	5 12 2
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5¼— 5½	5¼— 5½	..	..	..	4 1 10
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	106 —108	106 —108	..	..	..	4 3 4
50,000	India-Rubber, Gutta-percha & Telegraph Works..	10	10%	10 %	10 %	10 %	15½— 16	15½— 16½	..	..	+ ½	6 3 1
27,500	Liverpool Overhead Railway, Ord.	10	Nil	Nil	½%	Nil	⅜— ½	⅜— ½	..	..	..	Nil
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	4¾— 5	4¾— 5	..	..	..	10 0 0
600,070	London United Trams. (1901), 1 to 50,007	10	3 %	3 %	3 %	Nil	1¼— 2¼	1¼— 2¼	..	..	..	Nil
899,930	Do. do. 50,008 to 100,000	10	3 %	3 %	3 %	Nil	1¼— 2¼	1¼— 2¼	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	5%	2⅜— 2⅝	2⅜— 2⅝	..	..	..	13 0 10
1,881,000	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	67 — 70	67 — 70	67½	..	..	5 14 4
5,782,063	Metropolitan Consolidated	100	2½%	1 %	½%	½%	37½— 37¾	36⅞— 37½	37⅝	36⅞	— ½	1 6 10
2,640,914	Do. Surplus Lands	100	2½%	2½%	2½%	2½%	64 — 66	64 — 66	66	..	..	4 3 4
3,285,000	Do. District	100	Nil	Nil	Nil	Nil	16 — 16½	15⅞— 16	16	..	— ½	Nil
891,337	Metropolitan Electric Trams., Ord.	1	..	..	..	4½%	⅛— ¼	⅛— ¼	..	..	..	6 10 11
314,016	Do. do. Defd.	1	Nil	Nil	Nil	Nil	1/32— 1/16	1/32— 1/16	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	13/16— ⅞	13/16— ⅞	14/6	..	..	6 3 1
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	93½ — 96½	93 — 96	..	..	— ½	4 13 9
10,823,200	Mexico Trams Co., Common Stock	..	..	..	..	..	124¼—127½	124¼—127½	126	125	..	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	..	5 %	91 — 93	91 — 93	91½	91¼	..	5 7 6
245,500	Potteries Electric Traction	1	4 %	4 %	4 %	Nil	⅛— ¼	⅛— ¼	..	..	..	..
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	⅛— ¼	⅛— ¼	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	86 — 89	86 — 89	..	..	..	5 1 2
87,350	Telegraph Construction and Maintenance	12	15 %	15 %	17½%	15 %	34½— 36	34½— 36	34½	..	..	5 0 0
140,000	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	3 17 8
1,000,000	Underground Electric Railway, 5% Prior Lien	..	..	..	..	5 %	100 —101	100 —101	101	100½	..	4 19 0
2,800,000	Do. do. 4½% Bonds	..	..	..	..	4½%	86 — 88	86 — 88	..	..	..	5 2 3
4,900,000	Do. do. 6% Income Bonds	..	..	..	..	..	29 — 31	31 — 33	31	30½	+ 2	..
66,666	Willans & Robinson, 1 to 80,000 & 80,001 to 116,666	5	Nil	Nil	10 %	Nil	⅜— ⅝	⅜— ⅝	..	..	..	..
66,666	Do. 6 % C.P., 80,001 to 80,000 & 126,001 to 141,666	1	Nil	..	6 %	6 %	2 — 2½	2 — 2½	..	..	..	2 8 0
245,495	Do. % 1st Mort. Deb. Stock		4 %	4 %	4 %	4 %	76 — 80	74 — 79	..	..	—1½	5 1 3

ELECTRICITY SUPPLY COMPANIES.

15,000	Bromley (Kent) E.L. & P., 1 to 15,000		5½%	5½%	5½%	5½%	4⅛— 4⅝	4⅛— 4⅝	..	..	..	5 2 1
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	4½%	91 — 94 xd	91 — 94	..	..	..	4 18 9
80,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10%	10 %	10 %	6½ — 7⅝	6¼ — 7¼	7½	..	..	6 18 4
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	6¾ — 7¾	6¾ — 7¾	..	..	..	4 13 4
886,876	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	97 —100	97 —100	..	..	..	3 18 5
80,000	Charing Cross and Strand Electricity Supply	5	5 %	5 %	5 %	5 %	3¾— 4⅜	3¾— 4⅜	..	..	— ⅛	5 17 8
80,000	Do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4⅜— 4½	4⅜— 4½	78/11½	..	..	4 12 4
80,000	Do. "City Undertaking" 4½ % Cum. Pri.	5	4½%	4½%	4½%	4½%	3¾— 4¼	3¾— 4¼	..	..	..	5 5 11
445,786	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	98 —101	98 —101	..	..	..	3 19 3
49,486	Chelsea Electricity Supply, Ord.	5	6 %	4½%	4½%	4½%	3¾— 4	3¾— 4	..	..	..	5 12 6
175,000	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	10⅜— 10⅞	10⅛— 10⅜	10½	10⅜	— ⅛	5 11 8
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11½— 12⅜	11½— 12⅜	12⅜	..	..	4 12 4
400,000	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	121 —124	121 —124	..	..	..	4 0 8
800,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	102½	..	..	4 7 5
50,000	County of Durham Electrical Power, Ord.	5	4 %	4 %	2 %	..	1½— 2	1½— 2	..	..	..	5 0 0
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	2½— 3⅜	2½— 3⅜	..	..	..	7 8 2
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	5 %	93½— 95½	93½— 95⅝	..	..	..	5 4 9
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7⅝— 8½	7⅝— 8¼	7⅝	..	..	6 1 3
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅜— 11½	10⅜— 11½	..	..	..	5 7 10
400,000	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	4½%	105 —108	105 —108	107½	..	..	4 3 4
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	98 —101	£9 —101 xd	99½	..	..	4 9 1
80,000	Edmundson's Electric Corporation, Ord. Shares	5	4 %	Nil	Nil	Nil	⅛— ⅜	⅛— ⅜	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	3 %	Nil	Nil	⅛— ¼	⅛— ¼	..	..	..	Nil
480,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	57 — 60	57 — 60	..	..	..	7 10 0
$8,150,000	Electrical Dev.Co.of Ontario, 5% 1stMtg.Gold Bnds.	$500	..	..	..	5 %	91 — 94	91 — 94	92½	..	..	5 6 5
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4⅜— 4⅞	4⅜— 4⅞	..	..	..	5 12 10
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	4¼— 5⅛	4¼— 5⅛	..	..	..	4 13 6
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 0
15,000	Hove, 1 to 15,000	5	9 %	9 %	8½%	8½%	6⅞— 7½	6⅞— 7½	..	..	..	5 17 3
$1,376,000	Kaministiquia Power Co., 5 % Gold Bnds.	..	..	..	..	5 %	99 —101	99 —101	..	..	..	4 19 0
31,000	Kensington and Knightsbridge Electric Ord.	5	10 %	10 %	10 %	8	7 — 7½	7 — 7½	..	..	..	5 4 1
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 4 3
111,000	London Electric Supply Corporation, Limited, Ord.	1	4 %	4 %	2½%	2	1⅜— 2⅛	1⅜— 2⅛	..	..	..	4 16 0
70,000	Do. do. do 6 % Pref.	5	6 %	6 %	6 %	6	4¼— 5½	4¼— 5½	5⅛	98/9	..	5 14 3
682,355	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4½%	4½%	4	93 — 97	93 — 97	..	..	..	4 2 6
800,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	8 %	6½%	5	4 — 4½	4 — 4½	..	..	..	5 11 1
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅝— 5	4⅝— 5	96/3	..	..	4 10 0
235,000	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	4½%	105 —108	106 —109	..	..	+1	4 2 7
248,000	Do. 5% Mort. Deben. Stock Redem.	Stock	5%	5%	5%	5%	83½— 86½	83¾— 86½	..	..	..	4 0 11
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	..	5 %	5 %	5 %	5 %	80 — 82	80½— 82½	82	81½	+ ½	6 1 3
15,586,000	Do. Light and Power Co., Ltd., Common	$100	..	..	..	5 %	71 — 75	71 — 75	73	72	..	4 13 4
$2,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	7 %	102 —106	102 —106	103⅞	102½	..	6 12 1
$12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	..	..	..	..	5 %	85 — 87	84 — 86	85⅝	85½	—1	5 16 3
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	98 —100	98 —100	99½	99½	..	4 10 0
180,491	Newcastle-on-Tyne, 1 to 187,500	5	8 %	8 %	8 %	2½%	4 — 4½	4 — 4½	..	..	..	2 15 1
187,500	Do. 5 % Pref., 1 to 187,500	5	5 %	5 %	5 %	5 %	4 — 4½	4½— 5¼	..	..	..	5 10 2
126,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265	100	..	..	..	..	99 — 101	99 —101	..	..	..	..
10,852	Notting Hill Electric Lighting	10	7½%	7½%	7½%	7 %	12½— 13½	12½— 13½	..	..	..	5 6 0
20,000	Oxford, 1 to 96 and 407 to 20,310	5	7 %	7 %	7 %	..	6 — 6¼	6 — 6¼	6⅛	..	..	5 7 8
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,807	1	..	2½%	6 %	8 %	1⅛— 1⅛	1⅛— 1⅛	..	..	..	4 14 10
100,000	Do. do. 6% Non Cum. Pref. Nos. 1 to 100,000	1	6 %	6 %	6 %	6 %	1⅛— 1⅛	1⅛— 1⅛	..	..	+ 1/32	5 19 9
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	103 —106	103 —106	..	..	..	4 14 4
40,000	St. James' and Pall Mall Electric Light, Ord.	5	12½%	10 %	10 %	10 %	8¾— 9	8¾— 9	..	..	..	6 7 0
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	7 — 7⅝	7 — 7⅝	..	..	..	5 11 1
150,000	Do. do. 3½ % Deb. Stock Red.	100	3 %	3½%	3½%	3½%	84 — 88	84 — 88	..	..	..	3 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	Nil	Nil	Nil	2/32— 3/32	2/32— 3/32	..	..	..	Nil
65,000	South London Electric Supply, Ord.	4	4 %	3 %	4 %	5 %	2⅝— 3	2⅝— 3	..	..	..	6 13 4
125,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	2½%	1/32— 1/16	1/32— 1/16	..	..	..	4 8 11
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1/32— 1/16	1/32— 1/16	..	..	..	5 17 11
224,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	103	..	..	4 7 5
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	⅜— ⅝	⅜— ⅝	9/4½	..	..	25 6 8
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1— 1⅛	1— 1⅛	..	..	..	14 5 4
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	74½— 78½	74½— 78½	..	..	..	5 14 8
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 800,000	1	..	..	..	5 %	⅞— 1	⅞— 1	19/8	18/6	..	5 3 11
110,000	Westminster Electric Supply, Ord.	5	13 %	12 %	10 %	10 %	8⅝— 8¾	8⅝— 8¾	8½	..	..	5 12 8
81,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	5 %	4½%	4½%	4½%	4⅜— 5⅛	4⅜— 5⅛	..	..	..	4 5 9

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. Interim Dividend.

Bank rate of Discount 5 per cent.: October 22nd, 1909.

THE STEAM TURBINE OF THE OERLIKON CO.

This turbine is of the pure action type, with several pressure stages in a single casing. It is distinguished from other action turbines by the fact that in it use is made of the speed of exit of the steam from the revolving disks as well as of the inlet speed.

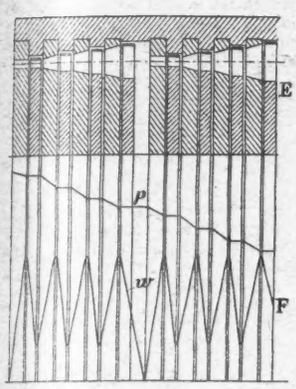


Fig 1.—Oerlikon Turbine; Steam Path, Velocity and Pressure Curves.

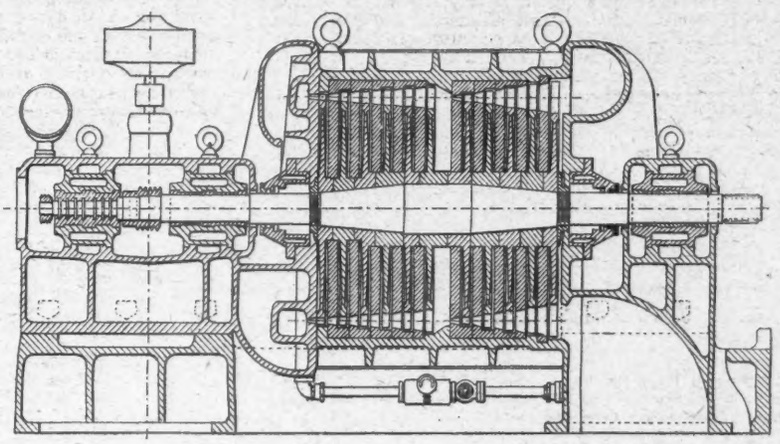


Fig. 2.—Sectional View showing Arrangement of Oerlikon Turbine.

For this purpose the turbine consists of one or more groups of pressure stages, each having an inlet arc of constant length, whilst the successive expansions of the steam are allowed for by increasing the radial length of blade from stage to stage within each group. Once the maximum practicable length of blade has been attained, the steam passes to a second group of stages, distinguised from the previous group by an increased inlet arc. This increased arc again remains constant throughout the various stages of the new group. The radial length of blade diminishes in general from the last stage of one group to the first stage of the next, and then increases again gradually from stage to stage.

In this way, the turbine makes use in each stage of the exit speed of the steam from the previous stage, except in the case of the last stage of each group. Fig. 1 shows diagrammatically the steam path in an Oerlikon turbine, having two groups of pressure stages. The length of blade in the first group increases step by step as shown, from 8 mm. to 51 mm. The second group commences with blades 15 mm. long, and ends with 48 mm. blades. The inlet arc forms 16 per cent. of the periphery in the first group, whilst in the second it forms 90 per cent. The manner in which the pressure falls from stage to stage is shown by the curve p. The initial pressure might be 144 lb. per sq. in., and the final pressure about $\frac{1}{100}$th part of this, or 1½ lb. per sq. in. From this pressure curve p, and the peripheral speeds of the revolving blades, the curve w for the speed of the steam within the turbine can be deduced.

As compared with some of the older action turbines, this turbine has the advantage of an absence of pressure difference between the two sides of each revolving blade wheel. The tendency to leakage is therefore reduced, and this is made use of by the Oerlikon Co. to increase the clearances everywhere, and so minimise the risk of breakdown. In place of clearances of a few tenths of a millimetre, the Oerlikon Co. use gaps of at least 1 mm. in the smallest sizes, and this is increased to about 2½ mm. in the larger sizes.

The effect of variations of speed and variations of steam pressure on the consumption of these turbines is shown in the following table. These results refer to the first 1,000-kw. 3,000-revolution turbine made, and improved results have since been obtained. In this turbine the radial clearance between the boss of the revolving wheel and the fixed wheel was 1¼ mm., between the revolving wheel and the outer cylindrical casing 4 mm., and the axial clearance between the revolving and fixed wheels was 3 to 5 mm.

Steam admission pressure. Lb. per sq. in.	Admission temperature. Deg. C.	Steam outlet pressure. Lb. per sq. in.	kw. output at generator terminals.	R.P.M.	Hourly steam consumption in lb.	Steam consumption per kw.-hour.
90	280·5	1·35	526	3,000	11,100	20·9
90	276	1·17	548	2 677	11,200	20·4
90	276	1·17	465	1,700	11,400	24·5
52	258	·82	304·7	3,000	7,200	23·7
74	253	·79	499	3,005	10,200	20·3
106	257·5	·98	765	3,010	14,600	19·2
136	271	1·21	1,004	3,000	18,400	18·3
166	280	1·48	1,243	3,000	22,200	17·9

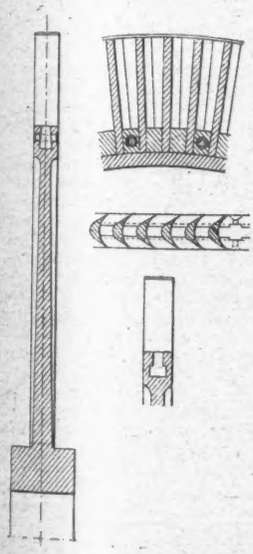


Fig. 3.—Details of Blading.

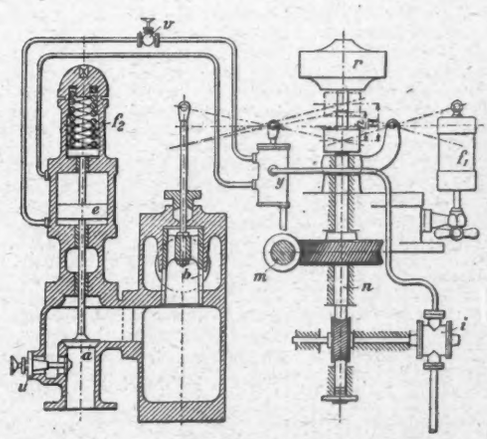


Fig. 4.—Governor Details, Oerlikon Turbine.

Fig. 2 shows a diagrammatic sectional view of an Oerlikon turbine. The rotor is carried in two bearings, one of which is arranged to take the end thrust which, as in all action turbines, cannot be entirely eliminated. Forced lubrication is employed and, in the larger sizes, provision is made for water cooling. All bearings are completely isolated from the steam. Labyrinth packings are arranged where the spindle enters the steam chest. The spindle is amply dimensioned and tapers from the centre outwards, so as to facilitate the mounting of the disks.

The stationary blade wheels are carefully fitted into the interior of the cylindrical casing, are in two pieces, and are made of forged iron. The fixed blades are machined out of the solid steel. They are given the exact theoretical shape, and are polished, so as to reduce the steam friction.

The revolving blade wheels, fig. 3, are shaped exactly symmetrical, and have a factor of safety of from 5 to 7. They are cut out of sheets of cast Siemens-Martin steel of the best quality. The blades and distance pieces are dovetailed into the rim of the wheel as shown, and are riveted at intervals. Each wheel is tested separately, before assembly, up to a speed 50 per cent. in excess of the normal, although the governor employed with these turbines limits the speed increase to 10 per cent. or 15 per cent. The revolving blades are carefully made in nickel steel. A steel ribbon riveted to all the blades limits the radial depth of the steam space. Turbines up to 20,000 h.p. are built on this plan, with a single cylindrical casing.

The governor employed is shown in fig. 4, and the way in which it is operated in starting up the turbine is as follows:—

By means of a by-pass u, steam is gradually admitted to the turbine by hand, and the turbine starts up. As it approaches the normal speed, the governor r, driven through worm gear from the turbine spindle m, takes over the regulation, and if the three-way cock v is open, the oil pump i is able to force oil under the valve

piston e, and this opens the stop valve a, and keeps it open against the action of the spring f_2. Should the speed exceed the normal by more than 15 per cent. however, the valve is automatically closed, and also should the supply of oil cease from any cause, the valve a is again automatically closed by the spring f_2. b is the regulating valve, y is an oil distributing chamber, and f_1 is an auxiliary spring, by the hand regulation of which the speed can be varied $\pm$ 5 per cent. The oil pump i supplies the whole of the forced lubrication as well as operating the valves as described. In order to shut the turbine down it is only necessary to turn the three-way cock v through 90: thus admitting oil to the top instead of the bottom of the cylinder e. An indicator is fitted to show whether the stop valve is open or closed at any time.

For overloads (or for normal load without condensation) live steam can be admitted direct to the second or third group of blades instead of to the first. The greater area of steam passages thus attained admits a greater quantity of steam.

The condensed steam from these turbines is found to be entirely free from oil.

A flexible coupling is provided between the turbine and its electric generator.—*Le Génie Civil.*

THE JAPAN-BRITISH EXHIBITION.

The erstwhile Lord Mayor (Alderman Sir George W. Truscott) entertained a large party to luncheon on Friday last at the Mansion House, to meet Prince Arthur of Connaught (hon. president of the Japan-British Exhibition 1910).

In proposing the toasts of "His Majesty King Edward VII." and of "His Imperial Majesty the Emperor of Japan," the Lord Mayor commented on the active interest which both Sovereigns were taking in the coming Exhibition.

The Lord Mayor, in afterwards proposing "Success to the Japan-British Exhibition," said he thought the company would agree with him that the happiest part of that title was the hyphen, which represented the alliance they all rejoiced in between the two great Empires of Japan and Britain. Proceeding, his Lordship said the project, which was to take shape at Shepherd's Bush next year, must prove to be one of the most interesting of modern Exhibitions. What they now desired was to call British manufacturers to arms, in order that they might show what they could do in the arts of peace. The Government and the people of Japan were ready and willing, as they had already demonstrated, to be the customers of England. It now only remained for the British manufacturer to enable them to be so. The foreign trade of Japan with the British Empire amounted to-day to something like £24,000,000, or 29 per cent. of her foreign trade taken altogether. It was surely worth our while to maintain that splendid commerce, and, if possible, to increase it. It had been suggested that possibly the Corporation of the City of London might see its way to take part in the British section, and that the leading City guilds might possibly arrange historical exhibits of the trades they represented, to add to the importance of that section.

Prince Arthur of Connaught, in replying, said: It gives me very great pleasure to reply to this toast, which you, my Lord Mayor, have so eloquently proposed. I feel I could not do better than quote the words of my revered grandfather, the Prince Consort, speaking at the Mansion House on a similar occasion in connection with the Exhibition of 1851. "No one," he said, thoughtfully considering the particular features of that Early Victorian era, "could doubt for a moment that it was an age of wonderful transition—an age tending rapidly to accomplish the end towards which all history pointed—namely, the unity of mankind. That unity," continued his Royal Highness, "was not one which broke down the limits and levelled the peculiar characteristics of nations, but one which drew them together with one great object—the mutual understanding and the general good of the human race." As commercial men, those here gathered together to-day are perhaps more fitted than the rest of the community to judge how much this material progress has helped towards realising that peace which the Prince Consort had so much at heart. What the Franco-British Exhibition has done in this direction is well known, and it promises well for the future to see so many gentlemen of standing and position in British commerce assembled together for the purpose of carrying out the organisation of yet another vast enterprise, which will help to draw the ends of the earth together, strengthen the bonds of political and commercial union between us and our gallant allies, increase the prosperity of both countries, and make for the advantage of each of our great Empires. That would have been the thought animating the great Prince whose words I have quoted: that, I venture to hope, will be the thought animating all present here to-day in connection with the Japan-British Exhibition. The co-operation of the City of London will be most valuable to the Exhibition; while the Lord Mayor's idea of the City Companies participating, in the manner he has suggested, would create a new departure in the history of exhibitions which I am sure our Japanese friends would greatly appreciate. The Japanese Exhibition, being of such a singularly interesting character, is bound to attract universal attention; and there is no doubt that thousands will come from all parts of the world to avail themselves of this splendid opportunity of seeing the treasures of the East spread out before them. I feel confident that our British manufacturers and merchants, fully realising the great importance of this Exhibition, will lend their strongest support by sending exhibits which will be worthy of so unique an occasion.

His Excellency the Japanese Ambassador, who also responded to the toast, said that the Government and people of his country had been doing their best to make their exhibits worthy of the occasion. According to accounts he had from home, the preparations were on an elaborate scale and in a very advanced state. The ambition of his countrymen would be to show to their allies their past achievements and prospects in the path of peaceful progress and development, and thereby bind more closely those important ties which happily united the two countries, politically and commercially. Those of his countrymen who would come over to England next year in considerable numbers would derive benefit from the examination of the splendid array of British exhibits which would no doubt be displayed at the Exhibition, and he hoped that would result in an increased demand for British products.

The Lord Mayor subsequently telegraphed to Prince Fushimi in Tokio sending hearty greetings from those present, and assuring the Prince that everything that can be done should be done to make the Japan-British Exhibition at Shepherd's Bush an unprecedented success, and the following reply has been received by the Lord Mayor-elect (Sir John Knill) from Prince Sadanaru Fushimi, who will visit the Anglo-Japanese Exhibition in London next year:—

Japanese Government, Tokio.

I am grateful to receive your hearty greetings, and appreciate your earnest desires for Anglo-Japanese Exhibition. Please convey my sincere thanks and earnest wishes for the complete success of the Exhibition to all the members.

PROCEEDINGS OF INSTITUTIONS.

Institution of Electrical Engineers (Birmingham Section).

Inaugural Address of the Chairman,

Mr. R. K. Morcom, M.I.E.E.

I have to thank you for the honour you do me in choosing me as your chairman for the coming session. In a way I feel that an apology is due. I am not actually myself engaged in electrical engineering, though I think I may say I am direct coupled to it. There appears to be no doubt that at present the electrical industry is passing through difficult times. There is a great deal of severe competition both home and foreign, and the market itself is not expanding as satisfactorily as in the past. I think that having, as I have, a keen interest in the progress of electricity, but being, as it were, on its borderland, I may be able to survey the position from a somewhat special point of view. More particularly I wish to consider the state of the primary branch of the industry—namely, large electrical engineering—which will be referred to as "the industry" in many places. With the object of getting into closer touch with internal opinion I referred to the reports of annual meetings and to the balance-sheets of the leading companies, and was surprised to note that at least one or two companies in every year since the beginning of the century complained of general industrial depression, although in the same years others might state that trade was satisfactory. Opinions being so conflicting I thought it advisable to analyse figures to discover to what extent depression or the reverse existed, by an examination of figures published or otherwise obtainable for the past few years.

In some respects the state of the electrical industry is difficult to analyse. Its development depends upon the development of a practically new science, and its progress is affected not only by the general progress of trade, but also by the success of its competition with older methods of attaining particular ends. If electricity were unknown, oil and gas could still give light and heat; ropes, belts, and shafting would transmit our power, and locomotives or horses propel our trains and trams. But the convenience of the electrical method is such as to make comparatively rapid headway in these fields.

In studying the period from 1900 to the present day from available statistics, it at once becomes apparent that immediately the disturbance caused by the South African War had subsided, the trend of trade was upwards on a very steep curve, except that 1904 and 1908 were noticeably periods of depression. So far as the Board of Trade returns for total imports and exports are concerned, the 1904 depression is masked by the demands of the Russo-Japanese War, whereas that of 1908 is obvious. To find the signs of the former depression we must go to other figures. Among the chief users of electrical power are the textile, the iron and steel, engineering, shipbuilding, chemical, and mining industries. A study of the Board of Trade returns for these industries reveals the signs of depression not in the textile industry, which shows a steady increase up to 1907, but in the others. In the iron and steel industry there was a decided falling off in exports during 1904. The chemical exports instead of increasing were almost steady, the machinery exports showed an increase less than that shown in either 1903 or 1905. Also there was a falling off in shipbuilding in 1903-4 for vessels for our mercantile marine. There was likewise a fall in the rates of increase of coal and pig-iron production.

The depression of 1908 is much more marked, and statistics show a retrograde movement all round—a very serious one in the textile trade, and actual decreases in all the other above-mentioned industries. As further indicating that these were years of depression, the returns of unemployment show a peak in both. It is to be hoped that the coming winter will show some alleviation of the unemployed position compared to last year, when it assumed such serious proportions.

Another important consideration bearing on the progress of the industry is to be found in the expansion of public supply, my authority for which I take from the latest edition of Garcke's Manual. The figures show that whereas there was an increase from 1906 to 1907 of 197 million units, the increases from 1907 to 1908 was only 104 million units. The increase of plant installed for supply undertakings have likewise fallen off considerably in the last year or two.

The traction figures for municipal trams extended but slowly during 1908. The expenditure of tramway companies was very considerable, but Mr. Garcke points out that the rate of growth of increase is not maintained, and a considerable portion was accounted for by railway companies' electrical expenditure. The Board of Trade returns treating of the electrical industry itself are incomplete and unsatisfactory. Roughly, they reveal that whereas our imports of electrical machinery have since 1903 maintained a fairly constant level of, say, £600,000, our exports have risen from just under half a million to about one and one-third million. Figures of electrical exports and imports, including machinery, have been subject to various adjustments and classifications which obscure them, but the position may be summed up by saying that the imports have shown an almost steady rise, while exports fell severely in 1904 and again in 1908. The exact value of our home market for electrical machinery is one that is difficult to estimate. The census of production figures for the industry are not available, and unlike some of our foreign competitors, we do not seem anxious to publish particulars of our sales. Occasionally some indication is offered in prospectuses, but incomplete and sometimes over-optimistic. I endeavoured to get at it in a round-about way as follows: I obtained, after considerable inquiry, particulars of the number of employés of leading firms. I also got from some of them the proportion existing between the export and home trade in a sufficient number of cases to suggest an average figure. The average was taken, the percentage from each firm being properly weighted by multiplying it by the number of employés. As the figures given were confidential I can only give my results as follows: This rate for 1908 works out at 31½ per cent. foreign and 68½ per cent. home. The figures are necessarily approximate only, but indicate that our home consumption is in the neighbourhood of £3,000,000, our exports one and one-third million, and imports half a million. In comparison with previous years our exports appear to have increased faster than the home consumption.

Another noticeable point has been the falling off in the ratio, in our home consumption, between work for public service to that for private service. A recent estimate of the municipal demand was about 1½ million per annum. To-day's figure is probably a good bit less than this. Estimates of the output of other branches of the industry, which I glean from evidence collected in the Tariff Commission's report, are that the home consumption of electrical fittings is between £300,000 and £400,000 per annum, of which about half is imported. For lamps the home consumption is about 20 million lamps, of which about 7 millions are imported.

So far the analysis has been chiefly confined to the consideration of the market for finished goods. The prices of raw materials will next be taken. The most noticeable feature of the century was the rise in price of copper in 1906-7 to a value double that prevailing in 1894-5. This rise, it will be seen, occurred on a falling market for electrical machinery, and was a factor in producing considerable distress to manufacturing concerns. The price of pig-iron from a very low figure in 1901 has risen steadily, and was in 1908 nearly 70 per cent. above the former figure. Under these conditions of output and prices of raw materials, what has been the progress of selling prices? As an indication I propose to take instances which represent the general trend, selecting the branch for which the figures are most easily accessible to me—namely, generating sets for coupling to high-speed engines. I propose to give the price per kilowatt of alternating and direct-current machines of about 250 KW. and about 1,000 KW. The averages thus obtained for 1901-2 were £3·6, £3·4, £2·6, £3·0 per kilowatt. These started at once to fall, first slowly, then rapidly in 1904, and then again gradually, till to-day the corresponding figures are £1·9, £1·85, £1·5, £1·55. The trend of prices has been similar in practically all branches of the trade, and in the allied industries of stationary engine building and steam turbine building. The increased price of raw materials in 1906-7 made no difference to the rate of fall.

The causes assigned for the fall are three-fold. Some put it down to foreign competition either real or feared, others to over-productiveness in the industry, others, again, to depression of general trade. A satisfactory feature is that up-to-date machines are better designed and more reliable than the older; they are better manufactured and much better standardised. A few years ago to meet the cut prices, some machinery was turned out of inferior design, but the mistake of such a policy has been clearly shown, and my own experience is that our manufacturers now turn out the finest machines in the world at prices far below their true value.

Year.	Large engineering.	Cables.	Lamps, fitting and wiring.	Traction accessories.	Instruments and accumulators.	Foreign agencies.
1896	1,700,000	1,400,000	880,000	—	450 000	130,000
1902	5,000,000	2,500,000	2,200,000	600,000	900 000	500,000
1908	9,000,000	3,200,000	4,300,000	500,000	1,400,000	500,000

A further point that needs consideration is the distribution of capital in the industry. The figures for this capitalisation are given in Garcke's Manual, but, unfortunately, they are very disguised by the inclusion of a large number of companies whose staple product is not electrical, or who are merely agents for foreign manufacturers. I have taken out revised figures which will, I think, put the position more clearly. Mr. Garcke states that from 1896 to 1906 the capitalisation grew from £6,500,000 to £40,000,000. I have attempted a closer analysis of the figures for the three years 1896, 1902 and 1908, which I tabulate as in the preceding column.

It will be seen that much the largest rise in capital has been in the industry I am specially considering, and this branch is the one which accordingly will suffer most from internal competition. The stress in other branches is more likely to occur from foreign competition or that due to the large engineering factories taking up accessories as a sort of by-product.

The tendency nowadays is towards wholesale manufacture and the accumulation of subsidiary manufactures into the hands of large firms whose business is of such a nature as to be akin to the particular subsidiary. It is generally a mistake to endeavour to link up two industries which requires staffs of absolutely different training. For instance, engine-building pursued by electrical firms has not on the whole been a great success, and probably always leads to waste in staff expenses. The heavy capitalisation which has been noted in the engineering section is one particularly worth note, and its effect may be usefully illustrated by a wider review than has been hitherto adopted.

In a way it is a young industry, but past its infancy. In its infancy it suffered from one very bad slump in the early and middle eighties, similar to that which recently hit the infant motor-car industry. This slump was undoubtedly due to the great rush of capital into an industry, based on a mistaken idea as to its immediate future. In the year 1882 alone nearly £9,000,000 of capital was raised for electrical enterprises. As a result, competition was so keen as to reduce profits to vanishing point. Improved methods of manufacture and gradual realisation of the over-eager anticipations of the companies gradually steadied the industry into one of increasing prosperity.

The progress of electric lighting, which came with the improved design and cheapness of lamps, continued steadily. Electric traction found more and more application, and up-to-date manufacturers, by adopting electric drive because of its convenience, cleanliness and economy, all brought grist to the mill, and a remunerative business was done during the closing years of the last century by a number of concerns whose names are household words with us.

The beginning of the twentieth century seems to have heralded harder times. The older companies, led on by their excellent trade, increased their capital, and new enterprise was tempted in by the evident prosperity of the business, till to-day we are again in the position that if all our works were full, the demands of our home and export trade would not be enough to take their output.

I find that, generally speaking, the summary of figures which I have so far given throws considerable light on the published remarks made at the various company meetings, which, as I previously mentioned, I had found somewhat conflicting. It is obvious that the sore straits in which some of them found themselves blinded them to the actual course of events, but, on the whole, they are so instructive and illustrative that I should like to abstract a few of them. In 1901-2 there was a great bustle in the industry, large factories were built, big extensions were made, and manufacturers were evidently starting on a big campaign of development. In 1903 there were general reports of improving trade and growing business, but here and there a complaint of small profits due to the inauguration of new factories. In 1904, apparently, foreign competition was severely felt, and a heavy fall of prices occurred. The report of Crompton & Co.'s meeting is so instructive that I will abstract it somewhat fully. The chairman stated that results did not compare favourably with recent years in consequence of general trade depression and continued competition, though there were signs of improvement. Prices were dropping fast, lists of standard goods falling as much as from 10 to 25 per cent. in a month. Public tendering was so keen that in one case there were 60 tenderers. Although they turned out more goods than in 1903, the money value was less.

In 1905 the general report was that competition was increasing in intensity, though the volume of business was improving. In 1906 came a rise in the price of raw material, in spite of which no corresponding rise occurred in prices. An interesting summary was given at the Electric Construction Co.'s meeting, the chairman reporting an increased output from the factory, but no increase in profits, in spite of careful organisation. They were not alone in this unfortunate position, which did not arise from lack of demand or foreign competition, but was solely caused by excessive expansion of production in this country. Three or four years before great preparations had been made for an increased supply of electrical machinery, which was only partially justified, the demand not being sufficient to provide employment for all. Average prices had been reduced by more than 30 per cent. in three years, in face of an advance in prices of raw material.

The evidence all points to considerable increase in the volume of trade in 1906 and 1907, in spite of a marked reduction in the increases of municipal expenditure. Reports show that improvements in organisation and design were having their effect in coping with the reduced scale of prices, but towards the end of 1907 the cheerful tone disappeared and a severe depression set in, the reasons for which, as well as its character, will be quite clear from what has been said about the very obvious slump of 1908.

It is certain that had it not been for increased productivity, the first seven years of this century, excepting 1904, would have been progressively profitable. In fact, 1906-7 were remarkably good years. The introduction of the metallic-filament lamp has undoubtedly reduced the requirements in machinery, and it remains for the increased cheapness and efficiency of electric light to stimulate the demand to a pitch when plant requirements shall

again assume an upward grade. Cheap electrical power is encouraging further industrial application, and if experience of heavy traction, at present on its trial, is satisfactory, it is only a matter of time before this application is extended. Tramway work is bound to extend with increasing urban population.

In shipbuilding more and more work is being done electrically, and the electrical requirements of the ships are growing, while at present the air is full of rumours of the close approach of electro-marine propulsion. All these things give hope that, as the capitalisation which caused the slump in the early 80's was justified in the 90's, that of the first decade of this century may be justified in the second.

But to cause such a demand, capital and enterprise are required. I use the word capital in the usually understood sense of capital in bulk. While freedom of capital may not so much affect the sale of an article which can be bought in penny lots, when it comes to an industry whose output comprises units costing hundreds or thousands, free capital is its life blood. Without it, we must look to great restriction of our home market, which is at present our chief one, with the likelihood of foreign competition such as occurred in 1904. The other great markets of the world are practically closed to us. Our Colonial industries, though growing rapidly, are not yet large enough to make up the deficit, and the same may be said of various non-manufacturing countries. The industry is so large and important that in foreign countries it receives special support from their Governments, and it is estimated that in Germany the number of employés increased from 1904 to 1906 from 72,500 to 95,000. According to Garcke, the comparative British figures for 1907 would be 45,000. It is estimated that the whole of the electrical industry in this country employs 300,000 persons, so that its prosperity may seriously affect the question of unemployment. In the large engineering branch capital must play a great part. Contracts are severe, and payments for the finished article are often held up for long periods. All the while the wages of labour must be promptly and fully paid. Capital is the fly-wheel of industry, which keeps things going steadily under the fluctuating impulses of demand, and enables the machinery to grind out at an even rate the current of wages. It is, therefore, the business of capital to keep wages secure. But it cannot perform this function rightly unless it is secure itself. Such security requires a large enough market. It is serious to note in Garcke's Manual that almost £7,000,000 of capital in the industry earns no dividend at all, and to observe the serious fall which has occurred in the Stock Exchange quotations for electrical securities. In an industry so specialised, and which requires a great amount of brain work, a great deal of expensive machinery, and large purchases of raw material, the capitalisation must be high. I find from figures of numbers of employés, and of the capital of a number of our leading companies, that on the average £300 of capital must be found to provide workshop, tools, security, and trade for every single workman.

The average capital expended on buildings and plant is nearly £200 per man employed. Careful organisation, with increasing trade, will enable this figure to be reduced. The staff expenses for technical and clerical work are necessarily very high, and add considerably to the dead charges. In many instances their total is as high as the wages bill; while, taking an average for the clerical staff of a number of the large firms, it will be found that one clerk is required for every three to four workmen. The importance of this clerical element is often overlooked when discussing the relation of capital to labour. I would like to enlarge upon the internal relations of manufacturing, but the information is very hard to obtain. In this connection the annual report of the American G.E.C. is most interesting. From the 1907 report I glean the following:—Area, 4,770,000 sq. ft.; employés, 28,000; cost, $1·12 per sq. ft.; orders, $60,000,000; capital, $64,000,000.

I have touched a little upon the great subject of the relations between capital and labour, but will refrain from discussing it at all in its political aspect, as I have refrained from remarking upon the tariff controversy. We are not a political institution, but one thing upon which we all are intent is to do our bit for the welfare of our great industry, and thus for our country. Our bit is for the manufacturer, designer, and consultant to see that our products, designs, and schemes for 1910 are so superior to what we have done before that our older works will be discarded, and their substitution bring in such a crop of orders as to give plenty of business and full employment to our engineers and factories alike. But not only must our 1910 goods be better than our previous ones, they must be better than any one else's 1910 goods.

We are now so well equipped with fine technical schools and universities, and they have such splendid men on their staff as professors, that we may rest assured that engineers are being turned out, equipped with the highest training, and able to hold their own in any competition. This, above all, will ensure our industry showing progressive improvement, which will keep the market alive.

A noticeable feature in the addresses of chairmen of local sections of late years has been the stress laid on the education problem, and very rightly, but we must see that the thing is done properly and not overdone. Education can narrow as well as broaden.

That a man in his time must play many parts has never applied to any one, I think, as much as to the modern engineer. It has been pointed out that he may have to be a physicist, mechanic, accountant, salesman, organiser of labour, and judge, and you cannot be educated to all that. All that our teachers can do is to lay the right foundation of knowledge and leave experience to do the rest. So much has been said and written by able men on this point that I can but refer you to their writings and words for guidance in forming your own opinions, but there is one point on which I feel strongly, and that is, that there is rather a tendency to discourage pure in favour of applied science. The value of mathematics in particular, as a training, should never be overlooked. Given zeal, I believe that mathematics, and plenty of it, will take a man further than any other training. It will give him that most valuable commodity, a well-ordered mind. A common experience is that if a student experienced difficulty in, say, advanced arithmetic, he would go back to it as child's play after a bout with algebra, and when algebra begins to get vague a dose of differential will send him back to scoff at the former difficulty, and so on into higher fields. A sound mathematician can always more readily specialise on a physical subject than another man—he is trained to reason.

Too many engineering text-books are now written which make a boast of their non-mathematical nature. It certainly makes the book fatter and more expensive, but mathematics are labour-saving appliances, and should be used. Those who cannot use them should take the results they produce for granted, like a labourer with a complicated automatic.

The number of successful barristers whose training has been mathematical is large, and any of us who have been in contact with a barrister on a technical subject must have been surprised at the great command of that subject which he can acquire at short notice. Take a mathematician, give him a workshop training, and let him read the technical papers instead of the sporting columns of the daily Press, and he will make an engineer. If he also has the gift of common sense and zeal for his profession he will make a good engineer. An engineer whose knowledge of mathematics and pure science is rudimentary is to his truly educated *confrère* much what a pianola player is to a pianist.

And this brings me to my conclusion on a point at which manufacturers, educationalists, and this Institution are on common ground. For it is only by keeping in the forefront of scientific production that we can hope to secure for ourselves a prosperous industry and a respected profession.

Physical Society of London.

At the meeting held on October 22nd, 1909, Mr. F. E. Smith read a paper entitled "On Cadmium Amalgams and the Weston Normal Cell." Cadmium amalgams may be solid, liquid, or a mixture of solid and liquid phases, the percentage composition of the phases depending on the temperature. When a completely liquid amalgam is cooled below the lower transition temperature, the centre of the resulting solid is of high cadmium concentration, and the outer skin of low cadmium concentration. Diffusion tends to produce uniformity, and in consequence the E.M.F. of a cell containing the amalgam is unstable for a considerable length of time. When the amalgam is slowly cooled to a temperature a little below the lower transition temperature, the difference of concentration between the inner and outer parts of the amalgam need be only small to enable the outer skin to be a two-phase system. The diffusion process will be slow and the E.M.F. may remain constant for a very long time. Amalgams which were of uniform cadmium concentration throughout were obtained by chilling completely liquid amalgams to a temperature of about —50° C.; although not initially stable, rapid diffusion processes resulted in these amalgams becoming approximately uniform throughout after a few days, and their electromotive properties were markedly different from those of slowly cooled amalgams. If, however, the temperature of such an amalgam is raised until two phases exist, subsequent cooling will not restore the uniform condition, and an unstable amalgam results. The experiments indicate that a 12·5 per cent. amalgam may be safely used at all temperatures between 12° and 60° C., and a 10 per cent. amalgam at all temperatures between 0° and 51° C. Experiments were made on the temperature coefficients of the anode and cathode limbs of the Weston normal cell, and show that if a difference of temperature of 1° C. exists, an error of about three parts in 10,000 is introduced.

A paper entitled "Production of Radium from Uranium" was read by Mr. Soddy. Measurements on the growth of radium in the three uranium solutions purified by Mr. T. D. Mackenzie between three and four years ago have shown that in all the growth of radium is proceeding at a rate proportional to the square of the time, within the error of measurement. The methods of testing have been improved, and the ordinary error is not greater than 10^{-12} gramme of radium. This result indicates the existence of only one long-lived intermediate product in the series between uranium and radium.

Mr. Soddy next read a paper entitled "The Rays and Product of Uranium X." Experiments have been made with the uranium X preparations separated with the help of Mr. A. S. Russell from 50 kilogrammes of pure uranylnitrate. It is concluded that the parent of radium cannot be the direct product of uranium X. The experiments, taken in conjunction with those given in the preceding paper, indicate that it is not a product of uranium X at all, but the subsequent history of the uranium X preparations must be awaited before this can be decided.

A third paper, entitled "The production of Helium from Uranium and Thorium," was also by Mr. Soddy. Helium has been detected in four experiments with uranium, in three with thorium, and in one with pitchblende solutions carried out according to the methods already published.

DIFFICULTIES IN SUB-STATION PRACTICE.

[COMMUNICATED.]

Owing to the introduction of alternating current for power and lighting distribution, the areas of electricity supply have within recent years become very greatly increased, and as a result the method of distributing power at extra high pressure and reducing it by means of static or rotary transformers has become increasingly prevalent. This has led to the development of an entirely new set of conditions as regards electrical operation, which, in practice, differ from ordinary generating station procedure. Up to the present not very much has been made of the special difficulties to which the attendants in electricity supply sub-stations are subjected, and it may, therefore, be worth while detailing in the following paragraphs typical instances of the difficulties which have been encountered, and the way in which they have been overcome.

Owing to considerations of rental values and the necessity of economising in ground space, it has become the practice in recent years to locate the sub-station either in the basement of one of the buildings in the supply area, or even under the street. This is more especially the case in the large centres of population, such as the metropolis. This introduces certain difficulties with regard to lighting and ventilation, which are ably foreseen and planned for by the architects having charge of the scheme. There are, however, incidental dangers with regard to the working of the supply which are not always predetermined. For example, in one sub-station, which was converted from an old steam plant engine room, located under a theatre, and from which the whole of the supply to the theatre was fed, the whole room was sunk under the level of the roadway, although contained within the building area of the theatre. In the reconstruction, a trap to a sewer 4 ft. above the floor level of the sub-station was left unnoticed, and remained unguarded by any protective device when the station was reconstructed. During a period of heavy load it happened, unfortunately, that a torrential rainfall flooded the sewer, and the sub-station floor became covered with water from the trap to a level of 3 ft., with the result that part of the high-tension switchgear was submerged. This, of course, partially interrupted the supply, and a considerable amount of confusion was caused in the area affected. The trouble was, however, diminished to a large extent by the prompt action of the switchboard attendants, who borrowed a fire engine and pumped out the water from the sub-station almost as quickly as it entered. The only device which was permanently put out of action was a small high-tension transformer on the high-tension board, which had to be removed and dried, and the oil renewed. After the station was cleaned out the trap to the drain was stopped, in order to prevent any recurrence of the trouble.

Another evil which can also be traced, in many cases, to the situation of the sub-station is the excessive amount of dampness in the atmosphere, and in this connection it may be urged that sub-station buildings placed below the level of the ground should be protected by double walling and sheets of damp-proof material between the two walls. In very marshy ground it is not too much to specify that concrete shall be freely used, and, at the lower levels at any rate, cavities should be left so that bitumen or pitch may be run in, in a continuous sheet, to form a protective course. If means are not taken to prevent the percolation of water there should, at any rate, be a provision for warming and drying the sub-station chamber. This can be partly done by the heat developed in the transformers, which undoubtedly has a drying effect upon the atmosphere, and may be assisted by providing a gentle circulation of air by means of a fan. If such precautions are neglected, serious accidents may occur upon the high-tension apparatus due to the deposition of moisture upon the insulators. In one sub-station the high-tension current is conducted along a path near the wall by means of separate rubber-insulated cables, cleated with porcelain insulators to the wall. When a damp cloth touched the glazed brick wall and the outside of either cable, as was almost inevitable when cleaning down the walls of the sub-station in the usual way, a number of crackling sparks were emitted, about $\frac{1}{16}$ in. long. Such disruptive discharges might very easily, in course of time, penetrate the insulation of the cable and cause a serious breakdown. The remedy adopted was to keep the walls near the cables quite dry by means of heat and fanning, as above described.

In many cases the switching arrangements of a transformer sub-station are very carelessly designed. So far as possible the rule which has become general in the generating station, that is to say, that each switchboard should be its own wiring diagram, should be followed in the sub-station, but owing to restricted space and the consequent crowding of apparatus, this rule is not followed so strictly as it might otherwise be. This has its effect in many instances upon the operation of the sub-station, as will be evidenced by the following incident. In one of the main transformer sub-stations on a widely-extended supply system it is the practice, after the load of the day has come down to a minimum value at about 1 o'clock a.m., to shut down all the transformers but one on each phase, in order to avoid the iron losses due to superfluous transformers. The switchboard attendant in this sub-station was not particularly careful to observe that the high-tension and low-tension switches which he handled corresponded in every case, and the result was that he left the low-tension side of one transformer connected to the network of the distributing area, opening all the other low-tension circuits, while he left the high-tension side of another transformer connected to the feeders. The result was that, as this particular sub-station was left completely isolated from the remainder of the low-tension system at night time, the load was cut off the whole of the area fed by this station. It was not noticed immediately, as the sub-station lighting was fed from a separate small transformer, and it was not until reports of the extinction of lighting were received that the mistake could be rectified.

Probably the majority of the difficulties occurring in static transformer sub-stations are due in some way or another to the transformers themselves. They are of the type of apparatus which causes trouble by being apparently so simple as to require no supervision, and in large-sized sub-stations the units are generally so bulky as to prohibit very frequent or thorough overhauling. For this reason supply and distribution by means of static transformers is not, perhaps, quite so simple a matter as it would appear at first sight. Quite apart from initial difficulties due to carelessness on the part of erectors—such as, for example, a case which actually occurred in which a transformer was completely burned out because it was connected up the wrong way about; that is to say, with the high-tension feeders connected to the low-tension terminals of the transformer—a good many unfortunate occurrences may take place during the course of running. In one sub-station of this nature three transformers of 50 KW. each, converting from 3,000 to 200 volts, failed one after another within 18 months of their installation. The trouble was at first attributed to defective design, and, on this being rebutted, all sorts of fantastic theories as to voltage surges along the high-tension cable breaking down the insulation were advanced. As a matter of fact, however, it was probably simply due to defective drying of the transformers, as, owing to some amount of urgency when the transformer sub-station was first put into commission, the transformers were not dried out at all in the sub-station before the oil was put in. They were never loaded beyond 75 per cent. of their full-load capacity, and, owing to a slowly increasing demand in the area, they had during this period plenty of time for rest. That this explanation seems to be the correct one is supported by the fact that upon the transformers being reinsulated they were run for a long period with full-load current through the coils, both before and after the oil was put into the transformer chambers, and this measure obviated any further trouble from this cause.

An experience with transformers due to a faulty coil in one of the windings may be of interest to engineers engaged in sub-station practice. One of the transformers suddenly broke down on night load, and refused to take up its share of the load. Curiously enough, the secondary coils appeared quite in order when a continuity test was applied to them. Moreover, the low-tension voltage was correct when high-

tension current was switched in on no load. The curious feature was that when the transformer was put on to its ordinary working load, it refused to take more than from 20 to 30 amperes on the primary, when it should have taken about 130 amperes. There was nothing for it but to return the whole transformer to the makers for repairs.

With the increasing use of oil-insulated, high-tension switchgear for sub-station practice, a note may be made concerning trouble which occurred in connection with one of these switches. It is not intended in any way to minimise the advantages of this type of switch, as it is undoubtedly the best form of construction for such an occasion, but it may be noted that care should be taken to guard against danger due to the expansion of hot oil in the switch chambers. In one such sub-station, high-tension switches were installed which worked in tanks of oil. On the top of the tank a hole was provided, about 1 in. in diameter, which served as an outlet for the oil in case of expansion. On one occasion, when a jointer was working over one of these switches, the oil shot out from the hole with considerable force, owing to sudden expansion and insufficient outlet, and completely spoiled the man's clothes. It is quite easily conceivable that such an occurrence might have much more serious consequences, as the oil was hot, and only a happy chance prevented the man's face from being in the way of the discharge. Since this occurrence, small zinc shields have been made and placed as baffle plates over the holes, so that any oil which is ejected from the switch chamber is diverted away from any person in front of the switch at the time.

The above notes do not profess to be any connected account in sequence of the difficulties which may arise in static transformer sub-station practice; they are merely given as examples derived from practical working experience which may serve as guides to correct items of practice as found at present, and having merit because they are derived directly from practical handling of the plant described.

NOTES ON TRADE ABROAD.

(*Concluded from page* 715.)

Traders Asking Questions.

From statistics quoted in the recently issued report of the Advisory Committee on Commercial Intelligence, it appears that the Commercial Intelligence Branch of the Board of Trade is being made greater use of every year. Personally, we have always found the Department courteously willing to assist us as editors, and the more the trading members of the community recognise this willingness and also the ability of the Department to furnish information of real value, the greater will be their desire to avail themselves of its resources. In the year 1906 the number of inquiries totalled only 5,544 (an increase of 25 per cent. on 1905), but in 1907 they were nearly doubled, being 9,231. The rate of increase in 1908 was not so large, the total being 11,267, of which 6,764 were written inquiries, and 4,503 personal. For the first half of the current year the inquiries made were at the rate of 12,558 per annum, but as the rate is continuously increasing the total for 1909 when ended will go a good deal beyond that figure.

For the benefit of trading readers who have never yet turned to the Department for assistance in times of difficulty, we may indicate briefly the nature of the matters covered in inquiries received from firms desirous of opening up or of developing foreign trade in specified countries:—

Commercial statistics; names of firms abroad engaged in particular trades or industries; import, excise, and consumption duties; port, harbour and tonnage dues and other charges on shipping; Customs regulations; foreign and colonial contracts open to tender; sources of supply and prices of commercial products; foreign patent, trade marks and merchandise marks legislation; regulations concerning commercial travellers; trading licences; Consular fees; certificates of origin; and methods of packing and means of transport.

The classified lists of possible buyers of British goods in foreign countries and British Colonies are revised from time to time, and specialised lists are supplied to British traders who make application for them. The report says that there is evidence that these lists are greatly appreciated.

Circulating Information.

For several years past the Department has reserved for British manufacturers and merchants only in the first instance, reports regarding possible openings for trade, &c. The circulation of this information to the various Chambers of Commerce enabled members of those bodies to have a reasonable start of foreign competitors who might later see the reports. But this favoured members of these Chambers to the exclusion of British firms who were not members but for whose benefit a Government Department exists quite as much as for anybody else. The present Committee in 1907 introduced an extension of the principle by establishing a list of British firms who desired to be kept directly posted in such matters by the Department. At June, 1909, there were on the list 1,321 firms, but we venture to believe that that number will be largely increased before long. Electrical firms would do well to avail themselves of this opportunity, and see what benefit there is to be derived from it. When we ask for Governmental assistance in the extension of our national trades, we should see that full advantage is taken of the privileges that are ours for the asking. It occurs to us that the Department may experience difficulty in confining its information to purely British firms, but no doubt it has a fixed line upon which it conducts searching investigations as to whether a firm desiring to go on the list is purely British, or is an importer with a British title. Otherwise we are simply helping the foreigner to supplement the information prepared for him by his own Government Consuls. After all, the foreigner in his own country, if he be better served with Consular information, as frequently appears to be the case, is already more favourably placed than is his British rival, and he may not need to take advantage of our Consular suggestions. Our advantage lies in the reports

Through British Spectacles.

being specially prepared for British eyes and for British manufacturers or exploiters, and they are of special value only when they are prepared by men who know something about what they are reporting upon. Our feeling has long been that a Consul who is looking after the possibilities of doing trade in cotton or pigs cannot give specialised or valuable information regarding electrical openings. He may tell us that an electric lighting or traction plant exists which means continuous demand for its cognate supplies, or that a scheme is on foot in such a place, but unless he has been associated somehow or other with electrical business or engineering, he is likely to overlook important possibilities, or to send information which, while being too meagre on important points, is almost extravagant in its detail regarding unnecessary matters. For the present, as we have said before, we have to accept what we can get as a general guide, and by despatching our own electrical representatives, who possess aptitude for searching out electrical possibilities, get really to the bottom of things, each for himself. It is a costly procedure, no doubt, so many of us covering the same ground, but there is so much to be done if we get "right there" straight away, that we may each well repay our own expenditure in the connections that we establish for the future, as well as by laying up for ourselves a knowledge of the market, gained from a close intimacy with it—knowledge that never entirely loses its value, though it might require refreshing every few years.

Ocular Demonstration for Trade Reporters.

As bearing upon the foregoing, we may say that it is very satisfactory to learn from the report of the Committee that newly appointed Consular officers, before proceeding to their posts, are now attached for a short period of service to the Commercial Intelligence Branch, and arrangements have also been made by the Foreign Office whereby H.M. Commercial Attachés, and occasionally H.M. Consular officers, visit the chief manufacturing and commercial centres of the United Kingdom from time to time, in order to become better acquainted with the kind of information which it is desirable should be furnished for the benefit of British trade. A little local acquaintance is better than none at all, of course, and if such visits are going to make Consular officials more efficient instruments in helping us in the commercial fight abroad, by all means let them take place. We fear, however, that any visitor, knowing no one branch of

industry better than others, and only having a general idea of all, would be likely to end with copious notes covering practically every class of industry, with everything electrical, everything engineering, everything textile, and so on; but much of this knowledge he could get without going. His Department, no doubt, arms him with all sorts of commercial reference books, but beyond all these is there not a further need? Does it not seem that reports or statements expressly prepared by a specialist in each of the various trade departments would be likely to bring out in permanent form for reference detailed particulars of just what the manufacturers and traders want to sell abroad, or the kind of things which by adaptation they can make? For example, let a man who knows, or is capable of intelligently ascertaining, all about the electrical engineering capabilities of the country, specialise on what electrical firms can do, or want to do, indicating, after conference with the representative electrical firms in different sub-sections of our industry, with what kind of information the Consuls can best aid them. Let specialists in the textile trades, in textile engineering, in railway engineering, prepare similar statements for these departments, and so on throughout the whole of the kingdom and through the whole length and breadth of our industries. Then place such information as this in the hands of the Government agent who is going abroad. A full mastery of its contents should form part of a man's training and equipment if he goes to represent British industrial interests. Would such material not be a safer guide for him than what he would be likely to pick up in a run through a score of commercial or manufacturing districts? If it be desirable, let the commercial expeditions of these *attachés* and Consular agents tour through the highways of our industries for the purpose of being profoundly impressed with their variety, their magnitude and their capabilities, and getting a pronounced local touch, but let them also carry back abroad the most complete specialised information in the form of the reports we have proposed. They will thus be doubly armed, and will be able to furnish us with just that kind of useful information for which we are all athirst.

Special Missions Abroad.

The report in its second section states that the policy of sending special commercial missions to various foreign countries and British possessions has been continued, such markets as Australia and New Zealand, Canada and Newfoundland, and Asiatic Turkey (Mesopotamia and Syria and Palestine) having been visited. In Section III it goes into the question of permanent trade representation in India and the Colonies, with a view to ensuring that a service of commercial intelligence, similar to that already afforded by H.M. Consular officers in foreign countries shall be maintained. The Crown Colonies and certain of the self-governing Colonies nominated 48 officers to answer inquiries, either from the Commercial Intelligence Branch, or from individual firms. Four special Trade Commissioners were appointed in 1908 to visit Canada, Australia, New Zealand and South Africa, these being Messrs. Richard Grigg, C. Hamilton Wickes, G. H. F. Rolleston and R. Sothern Holland, and the whole time of these gentlemen is devoted to the investigation of the trade conditions and requirements of the respective Colonies, with a view to watching the movement of foreign competition and to reporting on all matters which may tend to the promotion of new or increased trade between the Mother Country and other portions of the Empire. By means of the co-operation of these special commissioners, the correspondents already mentioned, and a number of local correspondents in Canada, Newfoundland, Australia, New Zealand and South Africa appointed by the Home Government, it is expected that our traders will derive considerable benefit in the promotion of business in the over-seas dominions.

Other Points.

Arrangements have further been made for the exchange of information between the Commercial Intelligence Branch and the Director-General of Commercial Intelligence in India. The Government of India has sanctioned a system of telegraphic communication with the Commercial Intelligence Branch, under which information required by firms in the United Kingdom may be obtained for them by the C.I. Branch on deposit of a sum sufficient to cover the cost of inquiry and reply.

Other points touched upon in this important report include the steps taken by the Branch to ascertain the probable effect of proposed changes in the tariffs of foreign countries likely to affect British trade. Further on, in alluding to the taxes imposed on commercial travellers in British Colonies, the report says that inquiries have shown that these taxes, though irritating and vexatious, particularly when levied in British Colonies on travellers from the United Kingdom, do not operate to any large extent in restraint of British trade, except in one or two instances in which the amount of the tax is very high. It does not appear that the British commercial travellers are under any greater disability in regard to these taxes than travellers of other nationalities. Therefore it is not proposed to take any action in regard to the matter. Those who decide to study this report *in extenso*, will find references to certificates of value for goods exported to the U.S.A., and to a proposed international conference on the laws relating to bills of exchange.

The Most "Live" Government Department.

We welcome the report as showing that the C.I. Branch of the Board of Trade is now year by year rendering more valuable assistance to the cause of British trade abroad. We profoundly hope that Department will be the most "live" of all the Government offices, that it will redouble its efforts in bringing its organisation legitimately to the assistance of our exporters, and that the electrical firms who are in need of such aid as it can give, will keep the Department well occupied with a continuous stream of intelligent inquiries.

The Workmen's Compensation Act.—Statistics have recently been published by the Home Office in connection with the Workmen's Compensation Act. Figures are generally dull reading, but these reveal some interesting facts with regard to accidents and industrial diseases. Particulars were required by the order of the Secretary of State to be furnished by certain industries, viz., mines, quarries, railways, factories, harbours, docks, &c., constructional work and shipping. These particulars were to include (*inter alia*) the number of fatal cases, the number of disablement cases, and the duration of the disablement. Particulars in relation to industrial diseases were to be given separately from other causes of death or disablement, and the nature of the disease was to be specified. The gross total of compensation paid to workmen in the above industries during the year 1908 was no less than £2,080,672. This represented 3,473 cases of death and 325,484 cases of disablement. It is clear from the statistics that of all workmen who have been affected by the Act, the miner should be the most grateful. One-third of the fatal cases during 1908 occurred in mines, while nearly one-half of the men who were disabled in the industries above mentioned are miners. Again, of the 2,260 persons who suffered from industrial disease, no fewer than 1,550 were miners. Of these 386 were cases of nystagmus, 6 of ankylostomiasis, 459 of beat hand, 537 of beat knee, 67 of beat elbow, and 87 of inflammation of the synovial lining of the wrist joint and tendon sheaths. It is noteworthy that none of the disease cases at mines had a fatal termination; there were, however, 1,689 disablement cases, in respect of which £13,382 was paid during the year; of these 139 (£2,490) were continued from the previous year. Of the remaining disease cases lead poisoning accounts for 421, anthrax for 23, arsenic poisoning for 15, chrome poisoning for 20, compressed-air illness for 10.

Sec. 8 of the Act requires that before a claim can be made in respect of disablement caused by an industrial disease, the workman must either have been certified by a certifying or other appointed surgeon to be suffering from and disabled by the disease, or have been suspended from his employment under special rules or regulations made under the Factory Act on account of having contracted the disease.

Returns which have been obtained from the certifying and other appointed surgeons of the certificates issued by them show that 1,562 certificates were issued, 66 certificates of refusal to certify disablement, 89 certificates of suspension, 7 certificates of refusal to suspend and 6 supplementary certificates under Regulation 5. Of the certificates of disablement, 3 related to ankylostomiasis, 319 to nystagmus, 1 to compressed-air illness, 312 to beat hand, 488 to beat knee, 67 to beat elbow, and 63 to inflammation of the synovial lining of the wrist joint and tendon sheaths. All of the above occurred in mines, except two cases of beat hand in factories, one case of beat knee in domestic service, and one case each of beat elbow and inflammation of the wrist joint in factories. The figures may be compared with the figures of cases in which compensation was paid during the year.

The latter considerably exceed the number of certificates of disablement or suspension issued by the surgeons. It is understood that in some cases the employer does not require a formal certificate of suspension from the certifying surgeon before admitting the workman's claim; and also that in some cases the certificate of the "works" doctor is accepted by the employer as sufficient.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

HAITI.—Invoices for goods sent to Haiti must state the marks, countermarks and numbers on and quantity of the packages, the detailed contents of each, the price of the goods, the freight, expenses, and port of shipment, and must be a literal reproduction of the consignor's books. If the goods are to order, the words "to order" must be inserted in lieu of the consignee's name. Invoices must be submitted to a Consul of the Republic for certification and must contain at the foot the following declaration to be signed before a Commissioner or other duly authorised person: "I affirm that this invoice is the faithful and true expression of the truth, that it agrees with my books in every particular; that no alteration has been made in the usual description in the weight, quality, or quantity of the articles therein specified." Invoices must be presented in triplicate and should state the exact net and gross weights. The net weight of each class of goods in one package should be stated and the origin of the goods should be declared on all invoices. The value on which *ad valorem* duty is calculated is the cost price of the goods at the place of production converted into legal currency with an additional 10 per cent. for expenses.

Surtaxes of 50 per cent. and 33⅓ per cent., in all 83⅓ per cent. are levied in addition to the duties named below. Duties are calculated in American gold, *i.e.*, piastre = 4s. 2d.

The following goods are admitted free of duty: Machines of all kinds and their accessories for industry, and also machines for the purposes of working the soil or preparing produce of the country; hydraulic presses, hydraulic wheels.

The following duties are payable:—

	Piastres.
Iron boilers	·50 per 100 lb.
Small bells	·50 per doz.
Axles, wrought or cast-iron	1 per 100 lb.
Wire, brass or iron	·05 per lb.
Lamps, complete, standing or hanging and so-called bracket lamps, fine	2 each.
Do. do. ordinary	1 „
Do. do. common, standing ...	·50 „
Do. do. medium	2 per doz.
Do. do. small	1 „
Chandeliers	20 % ad val.
Earthenware	·12 per 12 pieces.
Pipes, wrought or cast-iron	·50 per 100 lb.
Porcelain opaque	6 per hogshead.
„ fine and common	·03 each.
Goods which can in no way be assimulated to any entry of the tariff pay a duty of ...	20 % ad val.

NEW PATENTS APPLIED FOR, 1909.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

24,434. "Improvements in dynamo-electric machines." F. W. Carter. October 25th.

24,497. "Process of manufacturing material for metallic files of electric incandescent lamps." E. Ruhstrat. October 25th.

24,444. "Improvements in boosters, balancers, and motor-generators for use on direct and alternating current circuits." A. M. Taylor. October 25th.

24,453. "Improvements in circuit closers for automatic electric burglar alarms." H. B. Collier. (Date applied for under Rule 13, November 26th, 1908. An invention comprised in application No. 25,525 dated November 26th, 1908). October 25th.

24,498. "Method of utilising the gases resulting from reduction operations carried out in electric furnaces and electric furnaces for carrying out the same." A. Helfenstein. October 25th. (Complete.)

24,500. "Improved electric gas-igniter." F. Deimel. October 25th. (Complete.)

24,561. "Improvements in electrical conduits and accessories." L. Milne. October 26th.

24,565. "Improvements in or relating to electric arc lamps of the inverted or flame type." Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke G.m.b.H. Germany). October 26th. (Complete.)

24,566. "Improvements in electric arc lamps." H. Hirst and A. E. Angold. October 26th.

24,582. "Improvements in or relating to telephone receivers," B. D. Willis. (Date applied for under Sec 91 of the Act, October 28th, 1908, being date of application in United States.) October 26th. (Complete.)

24,602. "Improvements in and relating to arrangements of circuits for magneto ignition purposes." J. L. Milton. (Date applied for under Rule 13, October 20th, 1908. An invention comprised in application No. 22,271, dated October 20th. October 26th. (Complete.)

24,615. "Improvements in and relating to a telephone exchange system." E. E. Clement. (Date applied for under Rule 13, December 14th, 1908. An invention comprised in application No. 27,139, dated December 14th, 1908.) October 26th. (Complete.)

24,616. "Improvements in and relating to a telephone exchange system." E. E. Clement. (Date applied for under Rule 13, December 14th, 1908. An invention comprised in application No. 27,139, dated December 14th 1908.) October 26th. (Complete.)

24,631. Process for utilising the spongy zinc obtained electrolytically." October 26th. (Complete.)

24,632. "Electrically reset gravity escapement." W. D. Walden. October 27th. (Complete.)

24,671. "Improvements in reversing switches and the arrangement of the electric circuit connections therewith for the purpose of reversing electric motors." D. R. Lloyd. October 27th.

24,683. "Improvements in and relating to the sheathing of insulated electrical conductors." Siemens Bros. & Co., Ltd., H. W. Handcock, A. H. Dykes and J. J. Rawlings. October 27th.

24,687. "Improvements in electric exploders actuated by archimedean screws." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) October 27th. (Complete.)

24,697. "Improvements in or relating to electrodes for electric furnaces." L. Ruthenburg. October 27th.

24,704. "Improvements in telephone exchanges." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) October 27th. (Complete.)

24,716. "Improvements in electrolytic apparatus for the production of pure oxygen and hydrogen." R. Eycken, C. Le Roy and R. Moritz. (Date applied for under Sec. 91 of the Act, December 9th, 1908, being date of application in France.) October 27th. (Complete.)

24,733. "New or improved system of wiring for and connecting electric meters for office buildings, hotels, tenement houses, flats, and the like." T. F. Tate. October 28th.

24,735. "Improvements in electro-deposition apparatus." A. F. Harris. October 28th.

24,745. "An apparatus by means of which high voltage electric currents can be modified, measured and used for medical and other purposes." G. W. Chapman. October 28th.

24,769. "Improvements in ceiling roses for electric lamps." L. M. Waterhouse. October 28th. (Complete.)

24,770. "Improvements in electrical fittings, such as ceiling roses, fuse-boxes, switch and the like." L. M. Waterhouse. October 28th. (Complete.)

24,771. "Improved combination coupling for electric conductors." L. M. Waterhouse. October 28th. (Complete.)

24,784. "Electric hydraulic press." Maschinenfabrik Oerlikon. (Date applied for under Sec. 91 of the Act, November 19th, 1908, being date of application in Germany.) October 28th. (Complete.)

24,796. "Improvements in sound intensifiers for use in telephones and such-like instruments." E. T. Hincks. October 28th.

24,812. "Improvements in automatic telephone exchanges." Siemens Bros. and Co. (Siemens & Halske Akt.-Ges., Germany.) October 28th. (Complete.)

24,813. "Improvements in or relating to electrical heating apparatus." A. F. Berry. October 28th.

24,829. "Improvements in or relating to electric heating apparatus." A. Tepreau. October 28th. (Complete.)

24,843. "Improvements in and relating to the electric driving of vehicles." Akt.-Ges. Brown, Boveri et Cie. (Date applied for under Sec. 91 of the Act, December 18th, 1908, being date of application in Germany.) October 28th. (Complete.)

24,892. "Improvements in conduit fittings for electrical and other purposes, and in the manufacture of same." A. Brampton and F. Osborne. (Date applied for under Rule 13, April 10th, 1909; an invention comprised in Application No. 8,601, dated April 10th, 1909.) October 29th. (Complete.)

24,901. "Improved device for securing electric ceiling roses to ceiling-rose boxes." E. S. Bradburn and Drake & Gorham, Ltd. October 29th.

24,950. "Appliances or means for mounting incandescent electric lamps." A. W. Beuttell. October 29th.

24,968. "Improvements in electric welding." S. Jevons. October 29th.

24,992. "Improvements in devices for prevention of retardation in electric cables." W. E. Hitch. October 30th.

25,022. "Improvements in common battery telephone systems." W. Fairweather. (Aktiebolaget L. M. Ericsson & Co., Sweden.) October 30th. Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1908.

Telephone Systems. D. Sinclair and W. Aitken. 20,968. October 5th.

Electric Switches for Surface-contact Electric Traction Systems. W. M. Mordey. 21,089. October 6th.

Control of Dynamo-Electric Power Systems. Akt.-Ges., Brown, Boveri et Cie. 21,580. October 12th. (Date applied for under International Convention, October 14th, 1907.)

Portable Magnetic Compasses. L. W. P. Chetwynd, Kelvin & James White, Ltd., and F. W. Clark. 21,634. October 13th. (Cognate application, 4,338, 1909.)

Switch for Controlling Electrical Circuits. T. J. Rorke and E. Rorke. 21,674. October 13th. (Dated October 13th, 1908.)

Fluid-Pressure Governors especially applicable in Connection with Electrically-driven Air Compressors. British Thomson-Houston Co. General Electric Co. 21,765. October 14th.

Starting Switches for Electric Motors. E. Garside. 22,228. October 20th.

Insulators for Electric Wires or Cables. W. Copeland. 23,703. November 5th.

Signalling Systems for Railways and the like. British Thomson-Houston Co. (General Electric Co., U.S.) 23,727. November 5th. (Application for Patent of Addition to No. 20,542, of 1908. Date applied for under Rule 13, October 14th, 1908.)

Miners and like Electric Safety Lamps. C. V. A. Eley and T. P. Brady. 25,866. November 25th.

Magnetic Blow-outs for Electric Switches. T. von Zweigbergk. 25,955. December 1st.

Means of Charging Several Batteries in Parallel, and also for Regulating the Voltage on Electric Feeders. W. A. Stevens. 26,674. December 9th.

Dynamo-Electric Machines. Electromotors, Ltd., and E. Greenhalgh. 28,324. December 29th.

1909.

Holders for Electric Incandescent Lamps. F. W. Suter. 492. January 7th.

Leaflet for Telegraphic Despatches and the like. A. Moschini. 532. January 8th.

Air Heaters for Electrically-heated Air Baths. W. Otto. 1,922. January 26th.

Joints for Electrical Conductors and other Wires. British Aluminium Co. and F. Horn. 2,611. February 3rd.

Electric Time Alarm Devices. H. W. Lake. (Hasela Fabrik Patentierter Neuheiten C. Hubert Schaettgen.) 5,695. March 8th.

Electrical Process for Removing the Grease and Yolk from Wool and Apparatus therefor. R. Vandatte and B. Lagye. 5,859. March 11th.

Multiple Switch Starters. H. W. Lake. (Cutler-Hammer Manufacturing Co.) 5,909. March 11th.